WATER RESOURCES AND AGRICULTURAL DEVELOPMENT IN THE LOWER BASIN OF THE MEKONG

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A thesis submitted to the University of London for the degree of Master of Philosophy

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July, 1974

ABSTRACT

The Mekong, as one of the world's major rivers, has enormous potential in water resource development. Although the river can be developed to yield great benefits in the field of hydro-electricity generation and navigation improvement, it is the advantages that it provides for agriculture through flood control and irrigation which will make the greatest impact on the millions of people in the riparian countries of the Lower Basin (Khmer Republic, Laos, Thailand and Republic of Viet-Nam).

In the face of rapid population increase, the maintenance and eventual increase in standards of living must be sought in terms of agricultural improvement and modernisation. The traditional agricultural economy is still dominated by the subsistence cultivation of paddy rice, characterised by very low and unreliable yields. Some diversification has occurred in agriculture in recent years, but this has taken place on the marginal uplands, and the real basis for future food and export crop production will remain largely with the land already under cultivation which is predominantly paddy fields in the flood plain and the valleys. Intensification of agriculture and crop diversification on the existing lowland provides a better basis for agricultural development in the Lower Basin, which in turn depends on irrigation and environmental control, through the harnessing of the tremendous water resources of the river.

Recognising the importance of agricultural development and water control facilities, national

planning policies have given special attention to these areas. However, as an international river, co-ordinated efforts will not only be inevitable but would also yield added benefits. In view of this fact, the Mekong Committee has played a very significant role. Although there are still outstanding problems in the political, technical and socio-economic situation, the progress to date has been substantial and it seems a sound basis for further development has been laid.

ACKNOWLEDGEMENTS

I am particularly indebted to the Ford Foundation for awarding me a fellowship, through the agency of the Mekong Committee, to cover my initial two-year period at the University of London, and also to the Mekong Committee itself for allowing me to extend my study-leave in order to complete the work.

I would further like to thank many people who have so readily helped me in the preparation and completion of this study. Special thanks are due to Professor C.A. Fisher, Head of the Department of Geography, for his generous encouragement, and to my supervisor, Dr. Ronald C.Y. Ng, for his wise advice and academic guidance. I am deeply grateful to Mr. R.W. Bradnock for his help during the early part of my work, and to Mr. H. Demaine, who has so ably guided me through some of the less logical aspects of the English language.

I am also indebted to the other members of the staff in the Department of Geography and to the staff of the Mekong Committee for help with specific documents and maps.

Finally, I would like to thank Mrs. V. Williams for arranging so efficiently the typing of the final version of the manuscript.

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LIST OF ABBREVIATIONS USED

A.D.B.	Asian Development Bank
A.I.D.	Agency for International Development
A.S.R.C.T.	Applied Scientific Research Cooperation of Thailand
E.C.A.F.E.	Economic Commission for Asia and the Far East, United Nations
F.A.O.	Food and Agriculture Organization of the United Nations
G.D.P.	Gross Domestic Product
G.N.P.	Gross National Product
I.B.R.D.	International Bank for Reconstruction and Development (World Bank)
I.R.	International Rice (as in IR.8, an improved rice variety)
I.R.R.I.	International Rice Research Institute
Mekong Committee	The Committee for Coordination of Investigations of the Lower Mekong Basin (UN/ECAFE)
N.E.D.B.	National Economic Development Board, which later changed to National Economic and Social Development Board (NESDB) in 1972.
N.E.E.D.	North East Economic Development
N.E.E.D.P.A.G.	North East Economic Development Planning Advisory Group
N.S.O.	National Statistical Office
O.E.C.D.	Organization for Economic Co-operation and Development, United Nations
R.D.	Rice Department, Ministry of Agriculture, Thailand (as in RD.1, an improved rice variety)
U.N.	United Nations
U.S.A.I.D.	United States Agency for International Development
U.S.B.R.	United States Bureau of Reclamation
U.S.O.M.	United States Operations Mission

UNITS OF MEASUREMENT USED

Area	1 rai	=	0.16 hectare	= 0.395 acre
Weight	1 ton (metric ton)	=	1,000 kilogrammes	
Currency		20.8 bahts	=	1 US$
		50.0 bahts	=	1 pound sterling
	1962-68	35.0 riels	=	1 US$
		84.0 riels	=	1 pound sterling
	1969-70	55.5 riels	=	1 US$
		133.3 riels	=	1 pound sterling
	1971	130.0 riels	=	1 US$
		312.0 riels	=	1 pound sterling
	1964-70	240.0 kips	=	1 US$
		576.0 kips	=	1 pound sterling
	1971	600.0 kips	=	1 US$
		1440.0 kips	=	1 pound sterling

Symbols and Abbreviations used

-	nil or negligible
...	necessary data not available
ft	feet
ha	hectare (10,000 square metres or 2.471 acres)
kg	kilogramme
kg/ha	kilogramme per hectare
m	metre
mm	millimetre
m^2	square metre
m^3	cubic metre
m^3/sec	cubic metre per second
km^2	square kilometre
KW	kilowatt
MW	megawatt (1,000 kilowatts)

CHAPTER I

INTRODUCTION

In the literature concerning economic development problems, basic distinctions are constantly made between the rich and the poor countries, the developed and the underdeveloped. Although a variety of different measures may be taken as criteria of the level of economic development,[1] the basic feature of the developing countries is their overall poverty, with a low per capita income and low standard of living. According to Hodder,

> " By underdevelopment is meant that condition, characteristic of developing countries, in which levels and growth rates of real income and capital per head of population are low by comparison with Western Europe, North America and Australia." [2]

Underdevelopment then is a comparative concept and it is in comparing their low income levels with the developed world that the developing countries are making such extensive efforts to reduce the wide gap between the two groups' living standards by improving their own economic situation. These aims are not easily accomplishable and there can be no set formula for, nor short cuts to their attainment. The various countries of the developing world are confronted with a whole range of different problems; some have much greater natural resource endowment on which to build

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1. As considered in Norton Ginsberg, "Atlas of Economic development", 1968.

2. Hodder, B.W., "Economic Development in the Tropic", 1968, p.1.

their development than others; some have problems of extreme population pressure, others are relatively underpopulated; in some cases, problems of national security or internal unrest may sabotage the development effort. For each particular case a different strategy may be appropriate.

On the other hand, the developing countries as a whole do face certain common problems. One of these is the generally high rate of population growth, usually over 2% per annum and frequently rising to 3% or more. Such rates of population increase automatically reduce the rate of growth on a per capita basis, however rapid the overall annual increase in GNP. Real improvements in income levels and living standards for the majority of the population may be reduced to a minimum.

Another important characteristic of the developing countries as a whole is that the percentage of the population engaged in agriculture, fishing and forestry is relatively high. As Fry states,

> " A high proportion of the national labour force engaged in agriculture is a clear sign of a backward and impoverished economy since working population is mainly occupied with the basic problem of providing enough to eat.... " [3]

In most of the developing countries, agricultural production, whether of subsistence crops or of cash crops for export, still provides a large proportion of the national income and the success of the agricultural sector is basic to the growth of the economy as a whole. Improvements in agricultural productivity, whether by increasing yields or by diversification,

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3. Fry, D.W., "World Economic Development", 1965, p.10.

implies a more intensive use of the natural resources, improving the efficiency of the economy and raising the standard of living of the people.

The high proportion of the labour force in agriculture and other primary producing sectors in the developing lands contrasts sharply with the situation in the developed, industrialised world. These countries have developed their economies through industrial production and as a consequence, industrialisation appears a means to the end of economic development in the Third World. The possibilities for rapid industrialisation in the developing countries are, however, by no means favourable. Most of these countries lack a number of essential requirements for this process. Apart from raw material deficiencies, many lack, at least initially, the skilled labour and trained management necessary for industry and at the same time they may experience capital shortages. According to Wilson,

> " The two important shortages which do hinder Asian development programmes are those of capital and skills. The funds available for investment in development schemes are primarily dictated by the domestic savings and taxes of each country itself; given the low standard of living, the margin for capital accumulation is naturally small." 4

Abbas agrees in stating

> " It has generally been maintained and is undoubtedly true that the underdeveloped areas suffer from paucity of capital and that if capital were made available these areas would be developed." 5

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4. Wilson, Dick, "Asia Awakes", 1970, p.155.

5. Abbas, S.A., "Capital Requirements for the Development of South and Southeast Asia", 1955, p.4.

While this may overstate the case in that it is necessary for a country to be able to utilise any funds made available to it, it is a significant factor in the stimulation of economic growth, particularly in the industrial sector. This latter is partly dependent on the strength of the internal market and may be hindered by the low purchasing power of the mass of domestic consumers in the rural areas who derive most of their living from agriculture. In the absence of adequate domestic market opportunities, as Hodder notes,

> "....industrialisation in tropical countries must look for market opportunities in the developed world; yet it is difficult to envisage a situation in which the peoples of the developed world would be prepared to buy manufactured products from the developing countries when they can buy the same, probably better and cheaper products from each other." 6

Indeed, high production costs in the early stages of industrial development in the developing countries leaves them open to severe competition from the established producers of the developed world in their own domestic markets and may necessitate tariff regulations to safeguard even these.

Even where industrial production is expanding, the effect on the mass of the population in the developing countries may be strictly limited. The developing countries are faced with a basic choice in technology in developing their industrial sectors. The establishment of a modern industrial sector utilising capital intensive techniques may reduce costs and improve export possibilities, but it will probably lead to extreme spatial concentration of activity, usually

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6. Hodder, op.cit., p. 175.

around the major cities, and will minimise employment opportunities. However, the use of less advanced methods of manufacturing, using the so-called 'intermediate technology', would increase employment opportunities and the regional spread of industrial activity, but these techniques are likely to increase costs and reduce export prospects. Such industries are perhaps more appropriate where provision for the domestic market is the sole concern.

Whatever the choice of technology, the expansion of the industrial sector in the developing world cannot be isolated from the development of agriculture. For some time it is unlikely that the industrial sector will be able to absorb more than a limited proportion of those seeking jobs. With a rapid expansion of the labour force this may amount to no more than the maintenance of the proportion of the labour force already employed in industry. For the majority, employment will continue to be found in agriculture. At the same time those in the agricultural sector will have to expand production to feed not only their own increased numbers but also the increasing numbers of non-agriculturalists in the community. In many of the developing countries, moreover, the need is not simply to provide sufficient food, but to improve standards of nutrition in which many deficiencies still exist. Again if there is to be improvement in anything more than subsistence levels for the rural population, agriculture has got to generate a surplus which gives the opportunities to provide a cash income. This has become a necessity for those now in contact with the world consumer society and in its

turn it will increase the purchasing power of the rural areas and stimulate the domestic manufacturing sector. Finally the agricultural sector can produce many of the raw materials for manufacturing, reducing costly imports in the process.

Agriculture therefore seems likely to continue to play a critical role in the development process in the developing countries and neglect of this sector has already been shown to have a retarding effect on growth.[7] Only in a few cases, notably the oil-rich states, is agriculture likely to be of lesser importance. Certainly for the countries of Southeast Asia this is not likely to be the case. They have most of the characteristics of the developing countries already described. Agriculture is the principal occupation of the population and the low per capita income levels can be said to be due mainly to the generally low productivity of this sector of the economy. Farming in the region remains mainly a subsistence occupation and traditional methods of cultivation and relatively poor internal communications have prevented the widespread extension of commercial farming. Low rural incomes have given little opportunity for capital accumulation for further productive investments and the rural areas have fallen behind the urban centres in income levels to an increasing extent.

The state of the countryside has added to the problems of the countries of Southeast Asia. Population

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7. As shown by the changes in policy in successive 5-Year Plans in India, when an initial concentration on heavy industrialisation was followed by an emphasis on agriculture.

growth rates are high throughout and a high proportion of the population is now under the age of fifteen. The difference in urban and rural incomes is attracting more and more people to the urban areas, whose capacity to absorb them in adequate housing conditions has been surpassed. Employment opportunities in manufacturing are limited and the growth of industry is not helped by the lack of purchasing power of the mass of the population. The lack of development of the industrial sector in turn means that many of the Southeast Asian countries have balance of payments difficulties from having to import large quantities of manufactured goods to assist the development effort at a time when terms of trade have been turning against their traditional exports of primary produce.

The countries of Southeast Asia face much the same problems as other developing countries and in many ways the poor performance of the agricultural sector has contributed notably to these problems. The agricultural economy of Southeast Asia is dominated by the cultivation of paddy rice. The cultivation of the traditional subsistence crop expanded rapidly after the Western European expansion into Southeast Asia following the opening of the Suez Canal. Expansion of European rule and trade brought the commercial cultivation of paddy and the introduction of plantation crops in response to demand for industrial raw materials and for food crops in other parts of Asia. By the late 1930's Southeast Asia

> " ....produced 93 percent of the rubber, 90 percent of the rice, 90 percent of the cinchona, 75 percent of the copra and 55 percent of the palm oil, and also 60 percent of the tin entering the stream of international trade." 8

Even with the expansion of plantation crops, the developments under western rule did not essentially alter the agricultural economy of large parts of the region. Only selected areas were fully commercialised and although irrigation and drainage systems were developed in the deltas of the Irrawaddy, Chao Phraya and Mekong, the traditional practices of paddy cultivation had not changed. The transport systems were developed mainly to serve the areas of commercial importance, and, with few minor exceptions, industry was neglected.

With the exception of Thailand, all the countries of Southeast Asia had been colonised by European powers by the late nineteenth century; since the Second World War, all have achieved on independent status. Independence has brought with it many problems. Political stability has been one major difficulty in trying to hold together states whose boundaries had been decided in the colonial period and the emergence of Communism in North Vietnam has introduced a further unsettling effect into the region. Economically too, there have been problems. The colonial era left most economies unbalanced both in sectoral and in regional terms with intensive development of commercial agriculture in some areas and complete neglect in others.

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8. Fisher, C.A., "Southeast Asia", A Social, Economic and Political Geography, 1964, p.171.

Such was very much the experience of the four countries of the Lower Mekong Basin, Thailand, Laos, the Khmer Republic and the Republic of Viet-Nam. As has been noted above, of these countries only Thailand managed to maintain independence during the period of western penetration, while the three countries of Indo-china passed under the control of the French. In fact, prior to the arrival of French colonialism, Indochina was divided into a number of distinct regions; the Annamite empire controlled the Tonkin delta and the coastal plains of Vietnam, but its penetration into the Mekong delta had been limited; the Khmer kingdom was centred around the Tonle Sap and the lower reaches of the Mekong, although its control of the Mekong delta was not long past; in the present day kingdom of Laos, then known as Lan Xang, there were three small states centred respectively on Vientiane, Luang Prabang and Champassak, at various times under the influence of the surrounding Siamese, Khmers and Vietnamese.

In the pre-colonial period large areas of Indochina remained undeveloped. Agriculture was carried out by traditional techniques and only the Red River delta of Tonkin and the coastal plains of Annam were cropped with any intensity. The agricultural of the northern part of Annam was heavily influenced from China and more advanced techniques, incorporating water-control systems, dike construction and the skilful use of both night soil and manure made for more intensive utilisation of the land. In Cambodia, there were long-developed irrigation facilities and storage tanks around Angkor, but these were largely disused and generally cultivation in the

Cambodian and Laotian kingdoms was much less intensive.

After the area passed under the protection of the French from 1862 onwards there were a number of developments in agriculture, but these were heavily concentrated in the delta areas. Here the French constructed a series of major canals for draining the land and extending the network of waterways provided by the rivers. Older irrigation works and flood control structures were renovated. The Mekong delta was developed mainly for commercial rice cultivation, but elsewhere the economy underwent a slight degree of diversification, with cash crops like coffee, tea and rubber developed with French capital. With the expansion of rubber in Cochin-China and Cambodia, these two areas became major rubber exporters in the Southeast Asian region. The rubber, like the other cash crops, was consigned overwhelmingly to France. Despite the minor developments in crop cultivation, Cambodia, and especially Laos were comparatively little developed during the French period.

The break-up of Indochina into four independent states since the Second World War has only emphasised the problems of the area. Land-locked Laos had received little investment in the French period and remained poorly provided with communication links to the other part of the Lower Mekong Basin. Cambodia had a limited plantation sector in the economy, but still remained overwhelmingly agricultural. In Vietnam, the whole economy was disrupted by the split of the country into two halves in 1954 following the Communist takeover in the North. Essentially, the French had seen the two

deltaic lowlands of Vietnam as complementary; they had developed the overcrowded Red River delta as an industrial area for the whole of Indochina and had relied on the surplus rice production from the Mekong delta to make up for any food deficit in the north. The division of the country deprived one region of food supplies, the other of its source of manufactured goods.

Just as Laos was physically isolated within the realm of Indochina, so the Northeast region of Thailand, was separated from the rest of that country. It is not surprising that the region has the lowest level of economic development in Thailand. The area with a third of the population and area of the country, has an average per capita income which is less than half the country average.[9] The physical barrier of the edge of the Khorat Plateau is not only an economic but also a cultural barrier and the people of the region have tended to identify linguistically and culturally with Laos. A lack of direct communication with the Central Plain of Thailand until the construction of the railway between Bangkok and Khorat in 1900, led to the neglect of the region and, indeed, it was only the advance of the French into Laos, which was traditionally under Thai influence and control, in 1893 which caused the government to begin to develop the Northeast and as Keyes notes

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9. In 1971, per capita income of the Northeast was 1,860 bahts, while the average per capita income of the whole country was 3,840 bahts per year and that of the Central region 6,970 bahts. Figures from N.E.D.B., "The Third National Economic and Social Development Plan, 1972-76", 1971, p.169.

> " The modern means of transportation and communications which have been developed since the 1920's to connect the Northeast with Bangkok and the central region have had a marked effect on reducing the isolation which the region traditionally has had." 10

Nevertheless only since the emergence of revolutionary communism in Indochina has the Thai government given high priority to the improvement of the economic situation of the region. As described by Silcock,

> " Fear of external communist pressure... led to efforts being made to improve conditions in Thailand's Northeast region, where the standard of living was low because of poor soil and the mixture of Lao and Thai people favoured the penetration of communist propaganda." 11

The neglect of Northeast Thailand by the Thai government in Bangkok has meant that this part of the Lower Mekong Basin, like most of Indochina has seen little change in its basic agricultural economy. Throughout the Basin, with the exception of parts of the delta of Vietnam and Chiang Rai province in northern Thailand, the cultivation of the subsistence wet rice crop is carried out under rain-fed conditions utilising the traditional techniques long practised by farmers in the region. Thus cultivation is entirely dependent upon the annual environmental conditions and in this part of Southeast Asia, these are notoriously unpredictable. Unreliable in both amount and timing, the monsoonal rainfall can cause heavy damage to the rice crop, either through flood or through drought. Lack of

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10. Keyes, Charles F., "Isan in a Thai State", 1965,p.39.

11. Silcock, T.H., "Outline of Economic Development 1945-65" in T.H. Silcock (ed.), "Thailand, social and Economic/in Development", 1967, p.12.
Studies

control structures on the Mekong and its major tributaries means that heavy rainfall in the catchment areas of these rivers brings deep flooding to the delta, the shores of the Tonle Sap in the Khmer Republic and the valleys of the Mekong itself and tributaries like the Nam Mun and Nam Chi in Northeast Thailand. Elsewhere in the region, notably outside the major valleys in Northeast Thailand, in the western Khmer Republic and over much of lowland Laos, rainfall in some years can be so light as to prevent planting at all. Such conditions cause farmers to take elaborate precautions in cultivation to ensure, rather than maximise, yield and preclude the risk of investment in paddy cultivation.

The environmental conditions prevalent in the Lower Mekong Basin make the adoption of new techniques designed for increasing productivity unlikely without some improvement in the control and supply of water resources. The lack of such investment will in turn reduce the possibilities for increasing the standard of living in the rural areas of the Basin. Much of the problem of water control lies in the control of the River Mekong itself, the vast fluctuations in flow of which cause considerable damage each season. On the other hand, such is the vast quantity of water which passes down the Mekong each year that it is potentially the most important water resource in the region. If it were to be regulated, the scope for the use of its waters would be tremendous, not only for agricultural development through irrigation and flood control, but also for communication and power. A properly controlled Mekong could also serve as a vital transport artery

for land-locked Laos; its potential as a source of hydro-electricity could support the increasing demand for power for both industrial and domestic uses for many years into the future. Indeed, as Schaaf has suggested,

> " The Mekong harnessed can augment the potentialities for both industrial and agricultural growth to an incomparably greater extent than any other resource in the area." 12

The Mekong is however an international river, flowing in its lower course through three countries and forming the border with a fourth (Thailand) for long distances. As such, any attempt to develop the main stream, or indeed, its tributaries on any scale is unsurpassed in other peacetime agreements on the development of water resources. The concept of integrated river basin development is, of course, not new, the Tennessee Valley Authority scheme in the United States leading the way in such developments on major streams. The Tennessee Valley development indeed has many similarities with that planned for the Mekong River, but in that case the development required the co-operation of seven states within the U.S.A. rather than independent sovereign states. Since then, a number of agreements have been made on the use and control of international rivers, but in no case has the concept been as extensive as on the Mekong. The development of the Indus Valley waters, for example, was initially accomplished when all the Indian subcontinent was under the single rule of Britain and more recent sharing agreements have only been necessitated by the partition of the waters between

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12. Schaaf, C. Hart and Fifield, Russel H., "The Lower Mekong: Challenge to Co-operation in Southeast Asia", 1963, p.101.

India and Pakistan. Similarly the development of the Zambezi at Kariba was effected between two British colonial territories and the allocation of the Nile waters was carried out in similar circumstances.

Thus the agreement to develop the water resources of the Lower Mekong Basin has been a major step in international co-operation, which has involved not only the four countries of the Basin itself but also a number of other countries outside. The vast amount of investment required to carry out the project is clearly beyond the financial resources of the riparian nations alone and indeed, even in the initial stages, outside contributions have exceeded those of the Basin countries. At the end of 1972, total contributions to the project amounted to the equivalent of US$ 225 million, with 42% coming from the four riparian countries and the remainder coming from co-operating developed countries, United Nations agencies and other organisations.[13] Between 1972 and the year 2000 a total investment of US$ 12 billion will be required to carry the scheme through to its completion, a vast sum compared to that already expended.

It must be admitted that the vast expense of the Mekong project is a major constraint to its implementation, particularly in view of the disturbed political situation in the Basin at the present time. The Indochina war, extending in one form or another from the time of the Japanese invasion to the present day, has disastrously affected the economies of the riparian countries. The Republic of Viet-Nam, a major

13. UN/ECAFE/Mekong Committee, "Annual Report", 1972, p.104.

rice exporter in the pre-war period has been a net importer of rice since 1965; the Laotian economy is almost entirely dependent on foreign aid; the economy of the Khmer Republic has likewise been on a war footing since 1969. Such developments hinder investment in the Mekong project by the three states of Indochina and not surprisingly have reduced the enthusiasm of the fourth member of the Basin countries, Thailand, as well as the confidence of other contributing nations. Disruption of transport links and of agriculture by the warfare is also a major problem and although studies have continued, the unstable political situation is sure to impede development further. However, as Schaaf has it

> " In conditions of peace and stability, the Lower Mekong Scheme can be a tremendously productive undertaking. Indeed, all associated with it hope and believe that the Scheme will itself contribute greatly to just such an achievement of peace and well-being for all the people of the Lower Mekong Basin." 14

Thus, despite the political unrest and the consequent difficulty in obtaining financial assistance for the Mekong project, which are causing substantial delay in and, indeed, doubts about its implementation, it is felt valuable to examine the scope and the work of the Scheme in the context of the needs of the countries of the Basin at the present time. The development of water resources within the Basin is likely to remain fundamental to the success of agricultural development. The present study therefore needs to review the present state of agriculture within the

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14. Schaaf and Fifield, op.cit., p.129.

riparian countries, the plans for its further development and the major problems in this task. In view of the current political situation, a number of the points discussed will be necessarily speculative, but given a return to peaceful conditions some examination of them is held to be useful.

This study of agriculture and water resource development in the Lower Mekong Basin therefore begins by assessing the nature of environmental problem (Chapter II). It then goes on to discuss in Chapter III how the traditional rice farming in the area has come to adapt itself to the prevailing environmental conditions. Chapter IV suggests a number of pressures now being put on the traditional agricultural system and Chapter V looks at elements of diversification in the economy which might help to broaden its base. Government programmes to assist further development are reviewed in Chapter VI and the work of the Mekong Committee is set in this context in Chapter VII. Chapter VIII indicates that agricultural growth through water resource development is not merely dependent on the provision of physical facilities; problems of development illustrated by studies of individual tributary projects and other studies are presented. In conclusion, the role of water resource development in agricultural development in the Lower Mekong Basin is assessed.

CHAPTER II

THE PHYSICAL BACKGROUND OF THE LOWER MEKONG BASIN

I. The River Mekong and the Mekong Basin

The Mekong, one of the world's greatest rivers, has its origin in the snow-covered mountains of the great Tibetan Plateau in China. From Tibet, it flows about 4,200 kilometres in a southeasterly direction to reach the South China Sea, first passing through China's Yunnan province and then forming its boundary with Burma. When it leaves China, the river serves as the boundary between Burma and Laos before reaching Thailand at Chiang Saen. After forming the Laos-Thailand border for a short distance, the river sweeps directly east into Laos at Pak Tha. At Luang Prabang it turns south again and once more forms the Thailand-Laos boundary at Chiang Khan, where it turns to flow eastward to the open plain surrounding Vientiane, the capital of Laos. At Ban Dan in Thailand's Ubon Ratchathani province, the Mekong leaves Thailand and flows through southern Laos to reach the Khone Falls near the Cambodian border. The river then passes through a rocky channel with numerous islands and through the Sambor rapids to Kratie where it enters its flood-plain course. This section is characterised by sandbars and islands in the river-bed. From Kratie the river follows a southwesterly direction to its confluence with the Tonle Sap river at Phnom Penh, the Cambodian capital, where it turns abruptly south-east to enter the Republic of Viet-Nam in two branches, the Mekong itself and the Bassac river running roughly

parallel to it. Before it reaches the South China Sea, it further subdivides into some six distributaries.

The Lower Mekong Basin covers the drainage area of the Mekong River and its tributaries in the four countries of the Khmer Republic, Laos, Thailand and the Republic of Viet-Nam. Thus the area begins when the Mekong becomes the border between Laos and Burma and extends right down to its outflow into the South China Sea. Of the total drainage area of the Mekong and its tributaries, about 609,000 km.^{2} or approximately 77 percent is located within the confines of the Lower Mekong Basin.[1]

Table II.1 shows the area of the Lower Mekong Basin reviewed in terms of administrative units. As can be seen, the total area of the Lower Mekong Basin covers about 58 percent of the total area of the four riparian countries. It includes almost all of the area of the Khmer Republic and of Laos, the whole of the Northeast of Thailand and Chiang Rai province in its northern region and the Delta and part of the Central Highlands of the Republic of Viet-Nam. Figure II.1 shows the overall extent of the drainage basin of the Mekong. The area is inhabited by a population of about 31.9 million (1972) which constitutes nearly half of the combined population of the four countries, despite the fact that the two major capital cities, Bangkok and Saigon, lie just outside the Basin itself.

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1. UN/ECAFE, "Development of Water Resources in the Lower Mekong Basin", Flood Control Series No. 12, 1957, p.3.

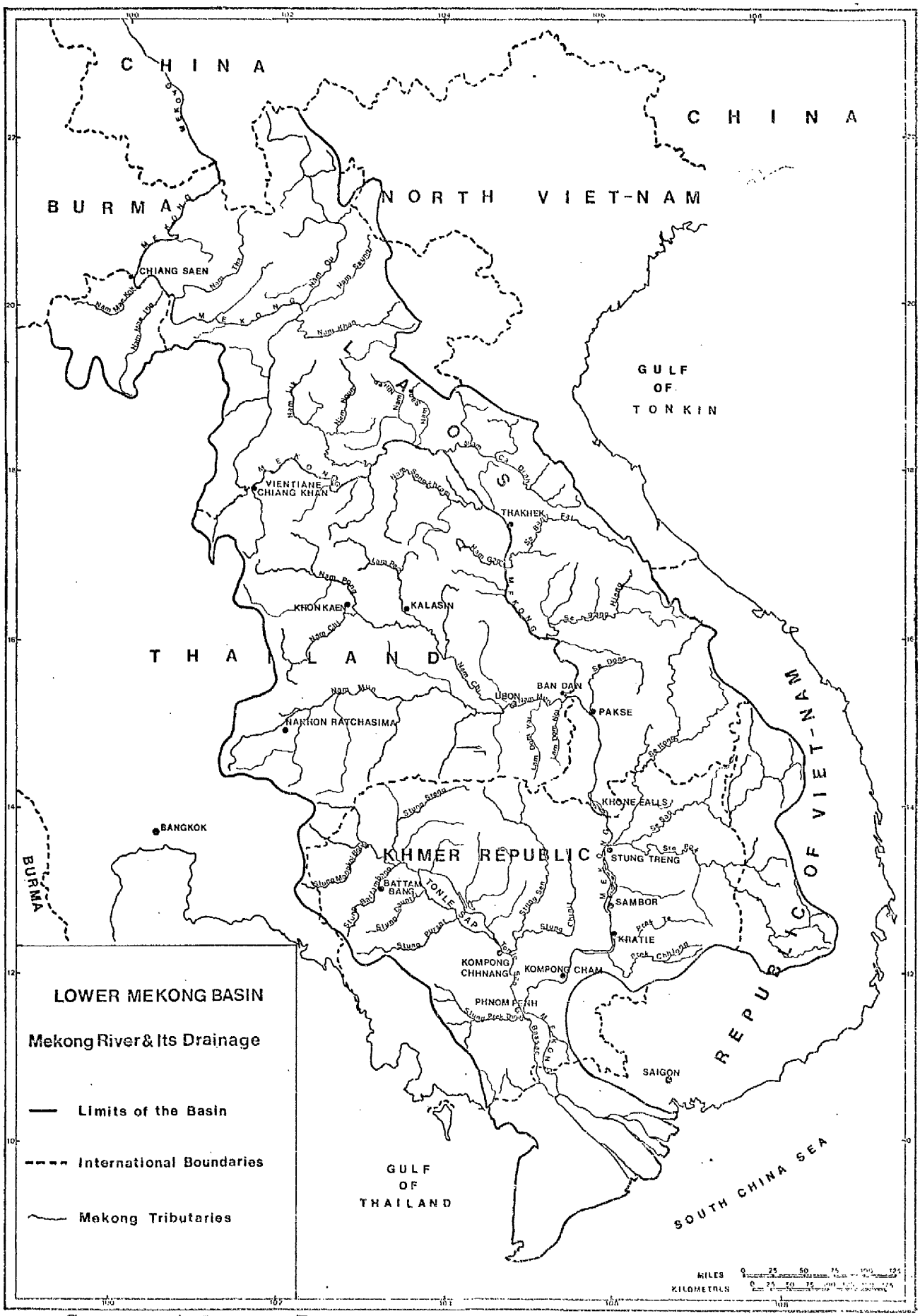
TABLE II.1

THE LOWER MEKONG BASIN: AREA AND POPULATION (1972)

Geographical Area	Area ($km.^2$)			Estimated population (000)		
	Total	Basin	%	Total	Basin	%
Khmer Republic	181,035	163,797	90.5	7,152	6,658	93.1
Laos	236,800	220,500	93.1	3,106	2,900	93.4
Thailand	514,000	189,029	36.8	38,577	14,753	38.2
Republic of Viet-Nam	173,263	72,029	41.6	19,067	7,550	39.6
Total	1,105,098	645,355	58.4	67,902	31,861	46.9

Source: Annual Statistical Bulletin, Mekong Committee, 1972

Figure II.1: The Mekong River and Its Drainage Basin



Source: Atlas of Physical, Economic and Social Resources of the Lower Mekong Basin, United Nations, 1968

For these people the Mekong River and its tributaries have had and continue to have a significant effect on the way of life and any review of agricultural development in the Basin cannot fail to take into account the physical characteristics of the River and the surrounding landscape. Structure and relief patterns, soil characteristics, climate and the hydrological pattern of the Basin all effect the relative success of agricultural production in the region from year to year. In the remainder of this chapter each of these factors will be examined in turn in some detail.

II. Structure and Relief

The Mekong Basin can be classified into four distinct structural elements, the high mountains, the uplands or plateaus, the lowland plain areas and the delta. The mountains surround the Basin in the east and west and in most parts of the north. Plateau areas with elevations varying mostly between 100-200 metres consist for the most part of the Khorat Plateau in the Northeast of Thailand, but this also includes the area on the eastern bank of the Mekong opposite the Khorat Plateau, namely the river plains of the Se Bang Fai and Se Bang Hieng in Laos.[2] The Mekong Plain is a lowland area mostly less than 100 metres in elevation and lying almost wholly in the Khmer Republic. The plain extends from the Khmer-Lao border in the north to Phnom Penh in the south. From Phnom Penh, where the Tonle Sap river joins the Mekong stretches the vast expanse of the Mekong Delta. Figure II.2

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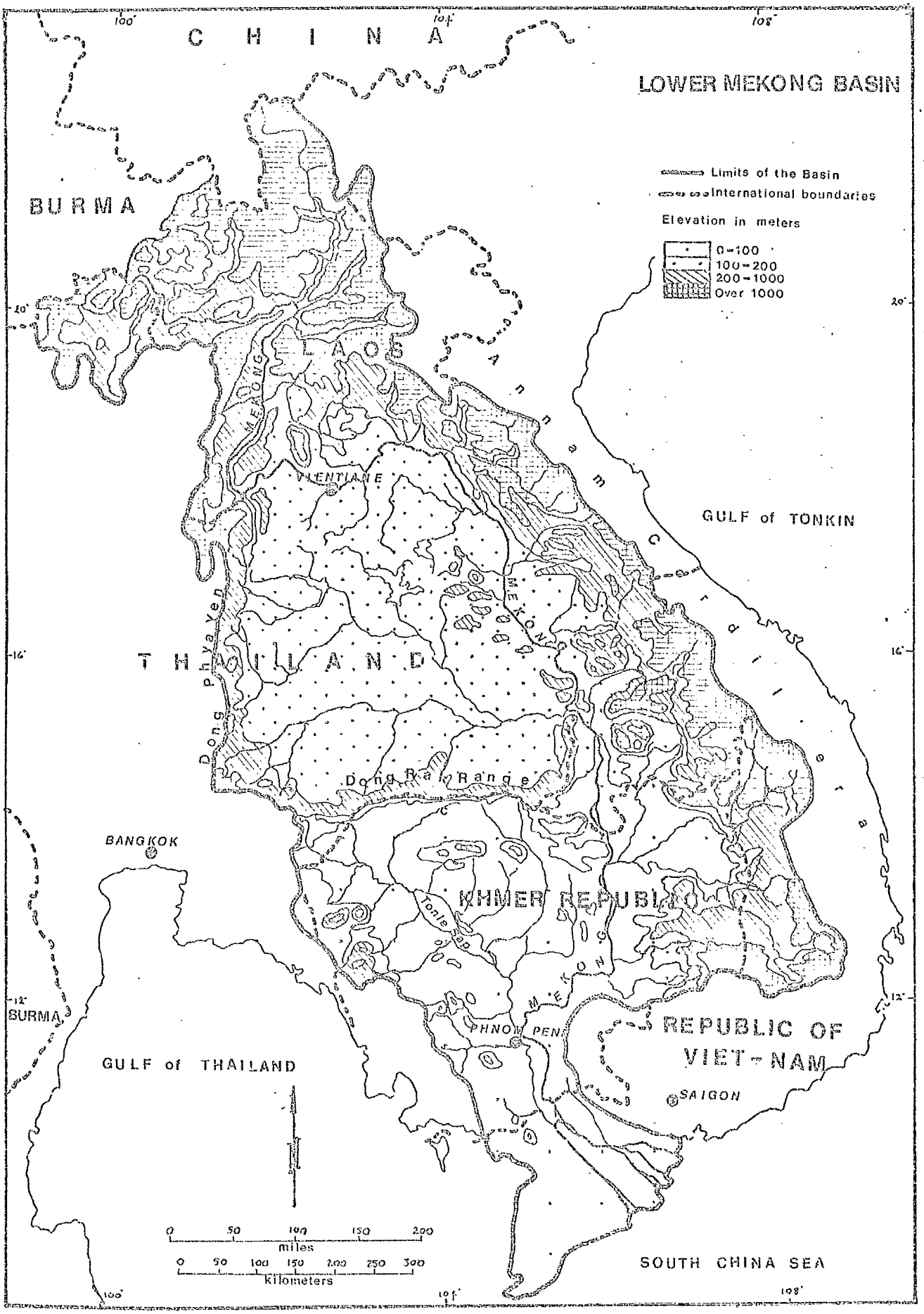
2. Ibid., p.3.

FIG. II.2 STRUCTURE and RELIEF



Source: A Review of Land and Water Resource Development in the Lower Mekong Basin, IBRD, 1972

shows the major relief divisions of the Lower Mekong Basin.

The northern part of the Lower Mekong Basin, which covers the whole of Northern or Upper Laos consists mainly of extensive rugged mountains and gorge-like valleys. It is a strongly folded mountainous area where the processes of erosion have carved a highly complex and dissected relief.[3] From the mountains of northern Laos, the Annamite Chain extends southwards to the east of the Basin, while the Petchabun and Dong Phyayen Mountains extend on the west and the Cardamom Mountains which are their structural continuation embrace the Basin on the southwest. There are several areas of lower elevation among the northern mountain ranges of Laos. The broad fertile plains of the Nam Ou valley north of Luang Prabang constitute an important lowland region in the west of the range, while to the east the only considerable area of low relief lies north of Xieng Khouang. This is the infertile limestone plateau of Tran Ninh, which is surrounded by mountains and has an average height of 1000-2000 metres above sea level.[4] On this plateau area is located the comparatively large plain known as the Plain of Jars.

The Annamite Chain, which extends in a south-easterly direction from the hills of northern Laos, forms the frontier between Laos and the Democratic Republic of Viet-Nam (North Vietnam) and the mountainous

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3. UN/ECAFE/Mekong Committee, "Report on Indicative Basin Plan", 1970, p.II-2.

4. Whitaker, Donald P. et al., "Area Handbook for Laos", 1972, p.12.

backbone of central Republic of Viet-Nam as far south of the delta area north of Saigon. The Annamite range is a series of eroded plateaus dominated by high isolated peaks.[5] The northern parts which resemble the mountains of northern Laos are narrow and very rugged in the frontier zone while to the south the Central Highlands of Republic of Viet-Nam are a series of plateaus. To the eastern side of the Annamite Chain there are steep slopes falling abruptly to the South China Sea, but there is a more gradual slope on the west toward the Mekong River where the range is buttressed by a series of plateaus, the most extensive being the Cammon Plateau (Khammouane Plateau) in the Khammouane province of Laos, from which the land slopes more gently westward toward the alluvial plains along the Mekong. Most of the valleys of the Lower Mekong Basin have several areas of bottom land and there are also several extensive plains close to the Mekong valley itself, where a number of streams flow down the western slopes of the Annamite mountains to join the main river. The Se Kong, Se San and the Sre Pok are the major tributaries draining these western slopes. Between the tributaries Se Done and Se Kong, east of the town of Pakse, is the large, fertile and generally rolling terrain formed by level beds of intruded basalt, which constitutes the Bolovens Plateau. This plateau is almost surrounded by a high escarpment and lies at an

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5. Naval Intelligence Division of the Admiralty, "Geographical Handbooks Series, Indo-China", 1943, p.19.

elevation ranging from 300-1200 metres.[6] The Bolovens Plateau geologically may be ~~a continuation~~ physically a western extension of the Annamite Chain.

The mountains which form the western boundary of the Lower Mekong Basin are the Petchabun Mountains and the Dong Phyayen Range which is its southerly continuation. These mountains extend from the northern hills of Laos and separate the Khorat Plateau from the central plain of Thailand. The Petchabun and Dong Phyayen Mountains have peaks ranging from 800 to 1300 metres above sea level. The Dong Rak and Sankamphaeng Mountains stretch in an easterly direction from these hills separating the Khorat Plateau from the Mekong Lowlands in the Khmer Republic. They have an average height of about 400 metres, but some peaks reach as high as 700 metres.[7]

The Cardamom Mountains and Elephant Mountains lie in the southwest of the Khmer Republic and separate the Basin from the Gulf of Thailand. The Cardamom Mountains rise abruptly from the Gulf of Thailand, but slope gently northward to the Tonle Sap lowland. The Elephant mountains have steep slopes on all sides and reach the coast at Kampot. They comprise a densely forested compact mass of plateaus and mountains with an average altitude of about 1000 metres.[8]

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6. U.S. Bureau of Reclamation, Department of Interior, "Pa Mong Project, Lower Mekong River Basin", Phase I Report, Vol. 4, Appendix IV, 1966, p.61.

7. Royal Institute of Arts and Sciences, Bangkok, "Geographical Index of Thailand", 1963, p.57.

8. Naval Intelligence Division of the Admiralty, op.cit., p.23.

Low plateaus or uplands cover most of the central part of the Lower Mekong Basin. The Khorat Plateau, largely an area of low plateau with rolling hills in the Northeast of Thailand, has its structural extension into Laos north and east across the Mekong River. It occupies an area of about 170,000 km.^{2}, one third of the territory of Thailand. The western and northern sides of the plateau vary in height from 130 to 200 metres, but the plateau slopes south and east so that at Ubon the level is in the neighbourhood of 50 metres.[9] The plateau has well-defined limits; the western and southern parts are rimmed by ranges of hills already mentioned, the Petchabun and Dong Phyayen Mountains on the west and the Dong Rak and Sankamphaeng Mountains on the south. To the north and east, the Mekong river forms the boundary of the Khorat Plateau proper and divides Thailand from Laos for most of its length. The landscape of the Khorat Plateau is characterised by broad, flat valleys, usually with one or more river terraces into which the present-day streams are incised. The valleys are separated by low, flat-topped interfluves in which the water-table stands well below the surface for most of the year.[10] Apart from the higher ground along the western and southern borders, most of the region is a gently rolling plateau that slopes to the southeast towards the Mun River Basin. The Plateau itself is drained to the east by two major tributaries

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9. Thailand, Ministry of Commerce and Communication, "Siam, Nature and Industry", 1930, p.7.

10. Dobby, E.H.G., "Southeast Asia", 1967, p.262.

of the Mekong, the Nam Mun and the Nam Chi, which have built wide flood plains extending deep into the heart of the region. On the extensions of the plateau in Laos the gently rolling plateau extends over most of the west of Savannakhet province in the east and in the north the Nam Ngum and Nam Lik rivers have formed a broad alluvial plain on its surface to the north and east of Vientaine.

The alluvial plain of the Mekong itself comprises the areas surrounding the Great Lake and the Mekong in the Khmer Republic, although the valley begins to open out south of Pakse. The plain is a low-lying flat basin of sedimentary beds with an elevation below 100 metres. The area is one of extensive deposition in the arm of the sea which has taken place probably within historic times.[11] The Great Lake is therefore an abandoned part of this gulf area. It forms a most distinctive feature of the Plain with the seasonally reversed flow of the drainage and the tremendous expansion of the surface area in the wet season. Most of the plain is composed of clay deposits, but there are small upland areas of sandstone enclosed within it.

The Mekong Delta covers most of the southern part of the Republic of Viet-Nam. It covers a vast area of about 49,520 km.^{2} of which a quarter lies in the Khmer Republic and the rest in the Republic of Viet-Nam.[12] The whole region is a monotonous plain with few parts

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11. Ibid., p.301.

12. UN/ECAFE/Mekong Committee, 1970, op.cit., p.II-4.

more than about three metres above sea level, generally made up of sticky mud with occasional belts of fluvial sands. Deposition is continuing in the delta at a rapid rate and the Ca Mau peninsula is extending southwestwards. According to Dobby

> " The Ca Mau Peninsula is a gigantic spit, built from Mekong materials carried southwest by marine currents. It is extensively forested and advancing seaward at 200 ft. a year so that charts of it are unreliable." 13

III. Soil Characteristics

Soil fertility is an important factor in determining the suitability of land for agricultural use. Though the application of fertilizer can raise low fertility levels, the fact is that fertilizer is still not heavily used in the Lower Mekong Basin area. The basic structure of the soil is therefore an important determinant of productivity, especially as related to water supply through its drainage characteristics, permeability and water-holding capacity. Soil structure in the Basin varies widely according to local climatic conditions, plant cover, relief and drainage conditions, but the major soil types may be described essentially according to their derivation from their geological base.

The soils of the Lower Mekong Basin range from the rich rice-growing alluvium in the delta and river valleys through the red soils of the highland plateaus to uncultivable sand and rock formations. The lowland soils are generally considered to be of moderate to high

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13. Dobby, op.cit., p.302.

fertility while the upland soils are mostly of low inherent fertility, although there are limited areas of more useful upland soils which support areas of intensive cultivation as in the rubber plantation areas of the Khmer Republic and the maize and cotton zones of Northeast Thailand.

Most of the mountainous area of the Basin is composed of poor soil of sandstone or limestone origin, although little detailed information is available about some areas, particularly in Laos. Although the river valleys which penetrate the mountains do contain local patches of alluvium, most of the lands bordering the Mekong river in the upland areas are characterized by red-yellow and gray podzolic soils. The most extensive areas of alluvial soils are to be found in the valley of the Nam Ou near Luang Prabang and in Sayaboury and Saravane provinces, although alluvial plains also occur along the Se Bang Fai and Se Bang Hieng. Two distinct areas of the Annamite Mountain foreland should also be noted. There are small areas of limestone-derived soil between the Nam Ca Dinh and Se Bang Fai rivers in Khannouane province and the 'terre rouge' resulting from the decomposition of basalt widespread on the Bolovens Plateau is also a source of more fertile land.

Geologically the Khorat Plateau, the major upland or plateau area of the Basin consists for the most part of fine sandstone and its sandy loam soils are rather infertile as well as being distressingly low in plant nutrients.[14] Typical soil types on the slopes

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14. F.A.O., "Report of FAO Mission for Siam", 1948, p.4.

of the plateau range from gray podzolic soils on the lower slopes to red-yellow laterised soil on steeper terrain. They are all generally poor soils with low water-holding capacity. Keyes observed that

> " Even the land which is cultivated is relatively poor because the main type of soil found in all except some small portions of the western provinces is porous, sandy loam which does not retain water and which has low fertility." 15

The main exceptions to this typical situation are the red-brown earths developed from alluvial and residual materials associated with limestone found on the undulating and rolling terrain of Nakorn Ratchasima and Loei provinces, which are of significantly higher fertility and are the basis of rich agricultural areas.[16] In the major valleys, of course, recent alluvial deposits of the low terraces and flood plains form useful paddy lands. The most extensive of these flood plain areas is the Mun valley extending from Phimai to Si Sa Ket.[17] On the northward extension of the plateau onto the Vientiane Plain in Laos, sandy soils cover most of the area, but the Nam Ngum and Nam Lik rivers both contribute alluvial and levee deposits of greater fertility.

Alluvial soils dominate the Mekong Plain in southern Laos and the Khmer Republic. As noted above, the plain has been formed by the sedimentation of an ancient arm of the sea and has been subject to an annual deep-flooding principally in those areas bordering the Great Lake and the major streams. The

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15. Keyes, Charles F., "Isan in a Thai State", 1965,p.78.
16. Thailand, Ministry of Agriculture, Division of Agricultural Economics, "Agro-economic Zones and Agricultural Development Planning", undated, pp.5-9.
17. Kawaguchi,K., "Lowland Rice Soils in Thailand",1969,p. 23.

Mekong and Tonle Sap rivers have built up natural levees and these, with their high retentive capacity for water are characteristically fertile and easy to till. The higher parts of the plain are predominantly characterised by latosols, but again some particular areas are worthy of note. On the edges of the basalt plateaus, partial laterisation has produced the red soils valuable for plantation agriculture;[18] these are predominantly in Kompong Cham and extend to South Vietnam just north of Saigon. Residual limestone hills in the north and west of Battambang province have produced black soils which also give areas of higher fertility.[19]

The vast area of alluvial soils stretching from Kompong Cham to the South China Sea which form the Mekong Delta are the largest fertile area in the Basin. There is in fact a broad range of alluvial and coastal deposits mainly of sticky mud, but with occasional belts of fluvial sands.[20] The sands often form a useful complement to the predominant heavy clays, although there are some infertile stretches and a further qualification must be made for those areas of the lower delta and along the coastal strip where the proximity of a marine environment leads to high salinity.

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18. Department of Mines and Technical Surveys, Ottawa, Canada, "Indo-China", 1953, p.19.

19. Yasuo, Masamoto, "Water Supply, Soil, and Soil Productivity in Cambodia" in "Water Resource Utilization in Southeast Asia", Symposium Series II, The Center for Southeast Asian Studies, 1966, p. 99.

20. Dobby, op.cit., pp. 301-2.

IV. Climate

The processes of formation of the soils described above are mainly controlled by the climatic elements and by the vegetation cover. The latter is itself partly a function of the climatic conditions and these also naturally are extremely important in their influence on cultivation practices. Variations in climate in the Lower Mekong Basin depend primarily upon the fluctuations in the timing and the amount of rainfall, rather than on temperature variations. In the Lower Mekong Basin, rainfall incidence fluctuates more than in other parts of Southeast Asia, and is a critical factor for rice farming in the area.[21]

Temperature has little constraining effect on agriculture in the Basin. Generally, high temperatures prevail throughout the year and there is a relatively small variation in air temperature from season to season. The small differences which do exist can be traced to variations in elevation and to seasonal and maritime influence. Temperatures in the Mekong Valley, the other smaller lowlands and on the Khorat Plateau are, of course, warmer than the northern mountainous area of northern Laos and the Annamite Chain, which act as something of a climatic barrier. Certainly the cold air of interior China is a rare visitor to the Basin.

Highest temperatures are experienced in the months of April and May at the end of the dry season when there is little cloud cover. Of the Khorat Plateau, Pendleton clearly describes this season:

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21. Ibid., pp. 290-1.

> "In the dry winter season, the northeast monsoon sweeps unhindered across Korat. These winds are quite cold, especially in the morning hours. This is the period of uninterrupted insolation from a cloudless sky. The relative humidity is so low that intensive evaporation thoroughly dries the surface soils and sand and dust storms are common." 22

The coming of the rains in May has the effect of lowering the average temperatures of the following months and more cloudy conditions may last until December, especially if low atmospheric pressure prevails as a consequence of typhoons.

Except at the extreme altitudes, the temperature is never low enough to prevent plant growth in the Basin. Annual mean temperatures in the region range from 75°F to 85°F (24°C-30°C) and the annual range is very small in the lowland areas. In the upper Mekong valley the annual temperature range is greater at over 9°F (5°C),[23] but even here temperature alone is not a restrictive factor in land use and agricultural development. It should be noted, however, that the high temperature, particularly in the cloudless dry season, means excessive evaporation and evapotranspiration when crops are planted at this time of year. Large allowances have to be made in irrigation to offset these sources of atmospheric loss.

Rainfall

Variation in rainfall is a much more important factor in the climate of the Lower Mekong Basin than

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22. Pendleton, Robert L., "Thailand, Aspects of Landscape and Life", 1962, p.128.

23. Department of Mines and Technical Surveys, Ottawa, op.cit., p.18.

is temperature change. The Basin lies wholly within the tropical zone of the northern hemisphere and is part of the monsoon region of Asia. The seasonal alternation of the monsoon governs the pattern of rainfall and seasonal temperature throughout the year. The tropical monsoonal climate is marked by two distinct seasons, the Northeast Monsoon or dry season and the Southwest Monsoon or wet season. The Northeast Monsoon is essentially the period of the dominance of the Northeast trade winds and although it blows off the ocean the bulk of the Lower Mekong Basin is shielded from its influence. By contrast the Southwest Monsoon is characterised by moist winds flowing inward from the warm sea to the warmer land and bringing with them heavy summer rains characteristic of the monsoon climate.

Rainfall in the Basin itself thus occurs almost exclusively within the period of the Southwest Monsoon from May to September, while, except in central Republic of Viet-Nam, the remaining months of the North-east Monsoon are almost devoid of any rain because of the rain-shadow effect of the mountains of northern Laos and the Annamite Chain. The Basin is occasionally subject to typhoons, the tropical cyclones which normally originate from the South China Sea or from the Pacific Ocean east of the Philippines and which bring heavy rains passing westward into the Basin during the period July-November. The maximum period of danger from typhoons varies according to latitude. From July to September the maximum danger zone is the north of latitude 15° (Luzon and the Gulf of Tonkin) while in October and November the area of maximum risk is on

the coast of South Vietnam to below latitude 10°.[24] However, like the Northeast trade winds, the typhoons lose most of their fury at the Annamite Mountains which protect the Basin on its eastern side and the areas which receive the greatest amount of rainfall are those along the windward sides of the mountain ranges.

Relief features have a very important role in the pattern of rainfall distribution in the Lower Mekong Basin. Throughout the Basin there are enormous differences in annual totals, in the length of the wet season and in the timing of the arrival of the main wet season rains. Although individual locations may vary widely from year to year according to prevailing conditions, the average for rainfall stations in the Basin ranges from about 800 mm. (32") to over 4000 mm (160"). The areas with the highest amounts of rainfall are the centre and south of Laos and the west coastal areas of the Basin, since the Southwest Monsoon strikes the mountain ranges bordering the coast of the Khmer Republic and then passes on to the frontal ranges of the Annamite Chain where again orogarphic lifting produces heavy rainfall than in the surrounding lowlands. The latter area also receives some rain from the North-east Monsoon. By contrast, the western provinces of the Northeast of Thailand and the plains around the Great Lake, which are largely sheltered by the mountain ranges receive less than 1000 mm. (40") and are the driest parts of the Basin. Figure II.3 shows the

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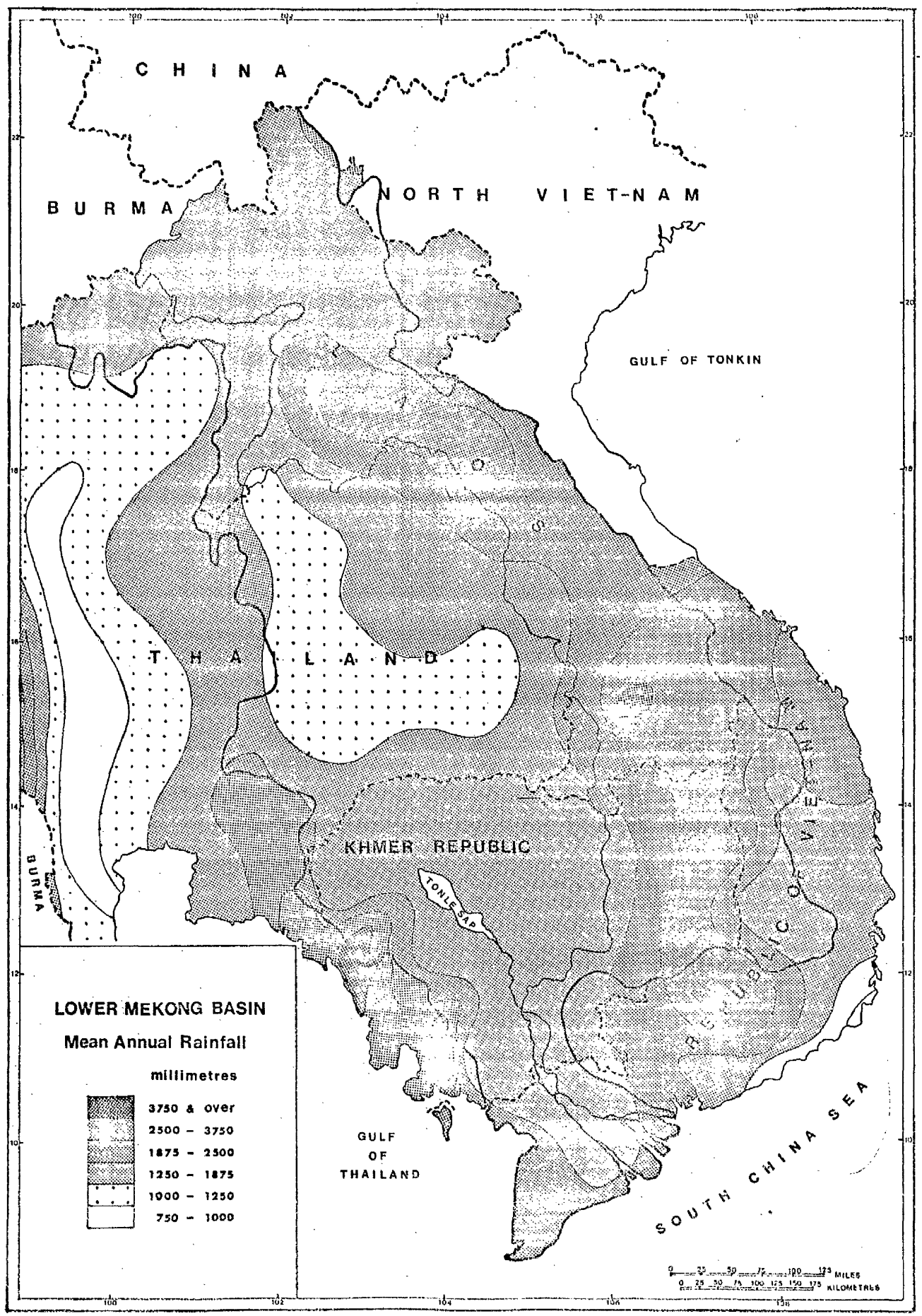
24. Naval Intelligence Division of the Admiralty, op.cit., p.59.

Figure II.3: Distribution of Mean Annual Rainfall in the Lower Mekong Basin



Source: Atlas of Physical, Economic and Social Resources of the Lower Mekong Basin, United Nations, 1968

distribution of annual rainfall in the Basin as a whole.

An important characteristic of the rainfall pattern in the Lower Mekong Basin is not only the contrast from place to place, but the variation from year to year too. The variation in annual rainfall is greatest in those areas of least rainfall, with the fall in Siemreap varying by as much as 67.5% of the mean figure each year. Over most of the Basin, the variation is much smaller, but it averages as much as 32% in the Great Lake basin as a whole.[25]

Laos receives some of the heaviest rainfall in the Basin, most of it coming from the Southwest Monsoon. Even some of the drier areas like the Vientiane Plain have an average of more than 1500 mm. (60") during the six months of the rainy season. Halpern states that

> " Luang Prabang province, along with most of northern Laos, is one of the drier areas of the country, receiving annually approximately 40-80 inches (1000-2000 mm.) of rainfall, while the Bolovens Plateau area in southern Laos has well over 150 inches (3800 mm.) in its central portions." 26

For the greater part of the country the average annual rainfall is between 1500-2500 mm. of which about two-thirds occurs in a rainy season of about 100-150 days of the year. (Figure II.4a and b).

When the summer monsoon comes from the southwest, the Khorat Plateau of Northeast Thailand, lying in the rainshadow of the Petchabun Mountains and the Dong Rak

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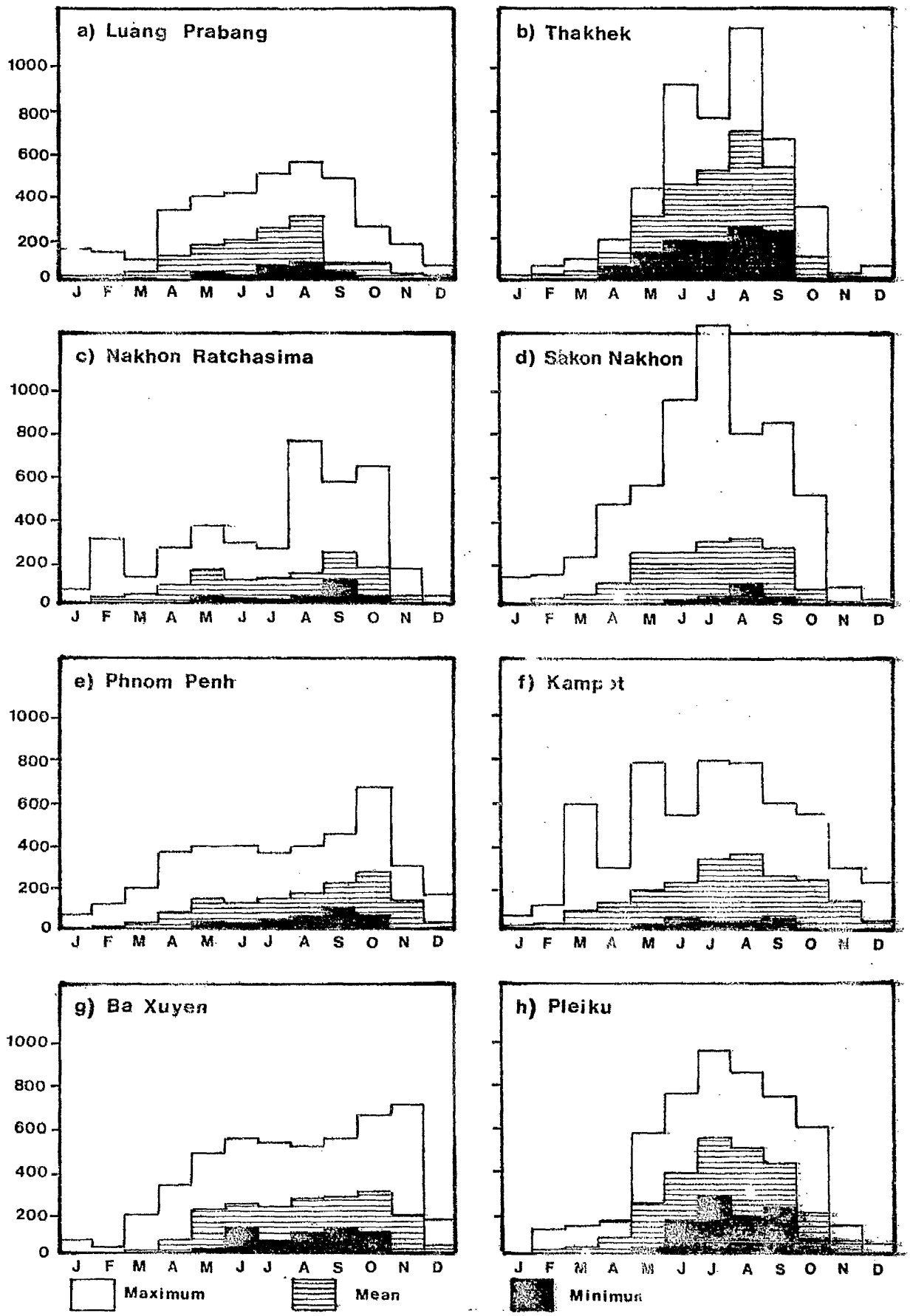
25. UN/ECAFE, Flood Control Series No. 12, op.cit., p.13.

26. Halpern, Joel M., "Economy and Society of Laos", A brief survey, Monograph Series No. 5, 1966, p.1.

Figure II.4: Mean Monthly Rainfall at Selected Stations in the Lower Mekong Basin (millimetres)



Source: Atlas of Physical, Economic and Social Resources of the Lower Mekong Basin, United Nations, 1968

Range receives much less rainfall than areas on the windward slopes of these ranges (Figure II.4c). As Pendleton explains

> "During the southwest monsoon the region lies in the lee of mountains to the south and west which reduce the rain-bearing winds and during the northeast monsoon it lies in the lee of the Annam Cordillera which cuts off similar winds from the east." 27

This double rain-shadow effect in Northeast Thailand can mean that in some years parts of the region scarcely have enough water to raise a single crop of rice even in the wet season, particularly when the low rainfall is set alongside the highly permeable sub-soil. On the other hand, the Southwest Monsoon in Khorat usually brings quite heavy rains to the area and there can be problems of too much rain in the river valleys. Kawaguchi notes that

> "Heavy rains of more than 1000 mm. in six months elevate river as well as ground water levels during the rainy season and drainage becomes ineffective." 28

Particularly heavy rainfall comes to the northeast of the region. These are subject to the influence of depressions coming from the South China Sea between July and September which are raised up by the low hills of the northeast of the plateau and augment the rainfall of Nakorn Phanom, Sakon Nakorn provinces and the east of Udorn Thani province to over 2000 mm. (80") annually (Figure II.4d).

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27. Pendleton, op.cit., p.127.

28. Kawaguchi, op.cit., pp. 51-2.

In the Mekong Plain of the Khmer Republic, rainfall is adequate for agriculture, but the onset of the wet season is often highly variable. Rainfall in August is sometimes inadequate for plant requirements. Due to the rain-shadow effect of the coastal uplands, the annual precipation in the lowland basin is less than 1500 mm. (60") and, as noted above this is highly variable (Figure II.4e). The coastal uplands on the other hand may receive as much as 4000 mm. (160") from the Southwest Monsoon moving off the Gulf of Thailand between May and October,[29] (Figure II 4f).

The average rainfall in the delta of the Republic of Viet-Nam is generally higher than other lowland areas in the Basin. Most areas of the delta receive 1800 mm. (60") although this ranges from 1000 mm. (40") in some interior parts to over 2400 mm. (96") in the southern area.[30] Despite this heavier rain, the delta can be affected by the late arrival of rains in May, although the greater problem is usually flooding especially when there is a high intensity of typhoons (Figure II.4g). In the Upper Sre Pok and Upper Se San basins in the Central Highlands rainfall is between 1700-2000 mm. (70-80"), most of which again falls over the period May-October.[31] (Figure II.4h).

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29. FOCUS, American Geographical Society, "Cambodia", Vol. XXI, No. 6, 1971, p.2.

30. Joint Development Group, "Postwar Development of Viet-Nam", 1970, p.511.

31. Ibid., pp. 470 and 473.

V. Hydrology

The highly seasonal pattern of rainfall and its relative distribution throughout the Basin has an important effect on the hydrology of the region. The difficulty of controlling the flow of the Mekong and its major tributaries up to the present time has meant that the greatest potential natural asset of the region has been rather one of its major problems and the pattern of human activity in the Basin has tended to adapt to the dangers imposed by the erratic and fluctuating water balance.

Although it is fed partly by snow-melt in its upper reaches, the flow of the Mekong River is derived largely from rainfall which is highly concentrated and this is reflected in the hydrograph of the stream during the year. The river level begins to rise, following the onset of the Southwest Monsoon, in May or June and reaches its maximum level in August or September. Hereafter the river falls rapidly once again until the end of the rainy season when it falls more slowly during the dry season to its lowest level in January. During the high flow period in the rainy season large areas adjacent to the river have been frequently inundated as a result of overbank flooding and this in turn impedes the drainage of surface run-off. By contrast, in the dry season, when the river flow is much reduced, the surrounding landscape frequently takes on an arid appearance.

Flow in the upper reach along the Burma border is relatively uniform as a result of snow melt from the Tibetan Plateau. The river flows in a deep valley

with steep banks until it reaches Chiang Khan and has received few tributaries. Nevertheless there is a substantial seasonal variation in flow even at Chiang Saen (Figure II.5a). The hydrographic station here shows the Mekong with an average annual peak flow of about 10,700 m^3/sec., while the average annual low flow is only 639 m^3/sec. (Table II.2). Below Vientiane, however, the variations increase to an even greater extent (Figure II5b and 5c). From Vientiane, the Mekong flows in a broad flat valley with occasional rocky islands and a sandy gravel bed as far as Savannakhet and then continues into the sandstone strata of the Khorat Plateau. A number of important tributaries have joined the river in this stretch and the velocity of the current during floods is as high as four to five metres per second.[32] Downstream to Kratie, the river is again in an open valley with rocky islands. Here current velocities become extremely high with the entry of a lot of water from the tributaries descending from the Annamite Mountains. Here, as may be seen from Table II.2, the average annual peak flow is 53,000 m^3/sec. compared with an average low flow of 1,764 m^3/sec.

From Kratie, the Mekong flows into its plain course and forms an alluvial river built up by flood deposits. At Phnom Penh it is joined by the Tonle Sap and separates into two branches, the Mekong and Bassac. Although the Great Lake can store as much as 19.3% of the mainstream flow as recorded at the Kompong Cham gauging station[33] and this helps to moderate the flood

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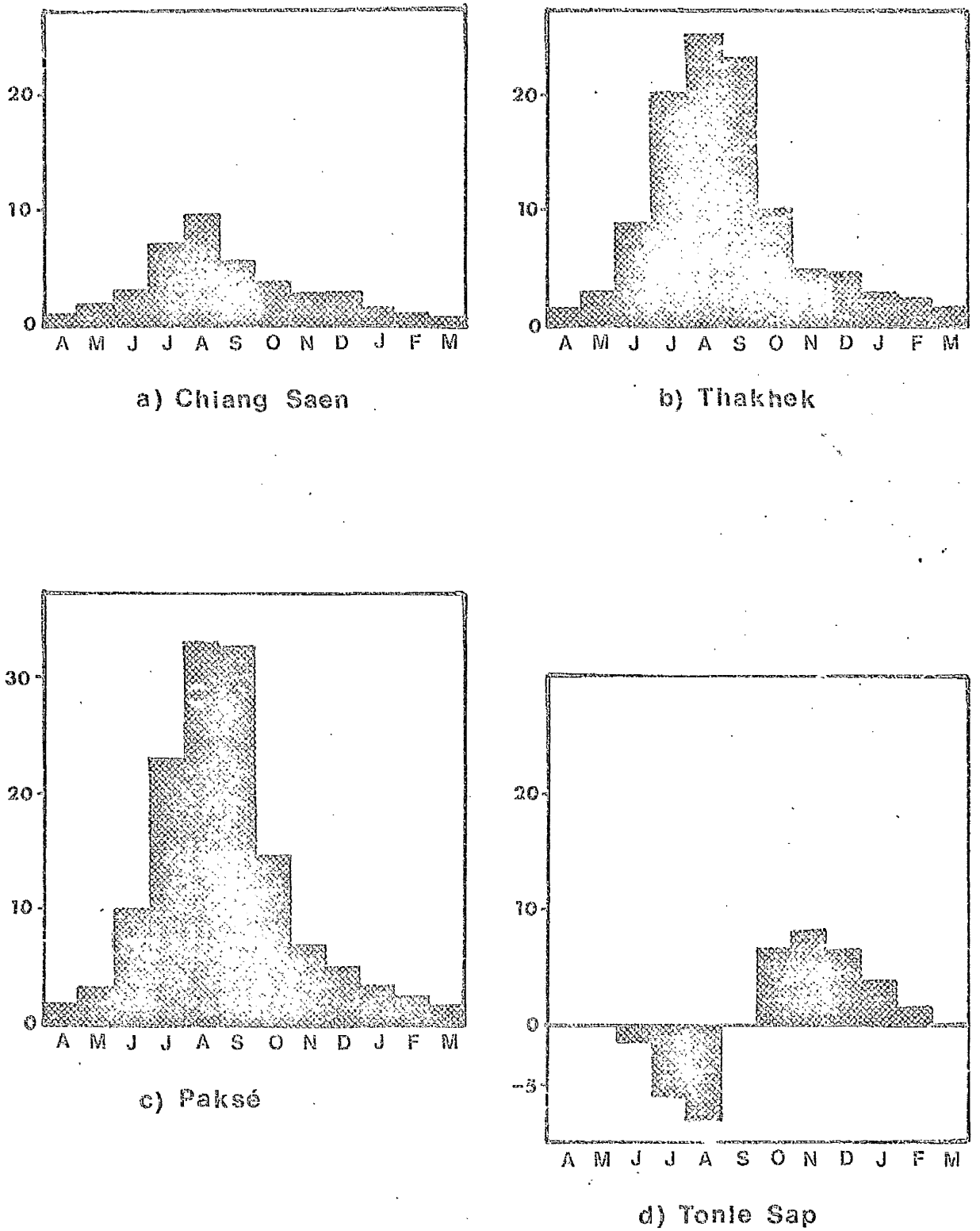
32. UN/ECAFE, Flood Control Series No. 12, op.cit., p.10.

33. UN/ECAFE/Mekong Committee, 1970, op.cit., p.III-2.

Figure II.5: Variation in Average Monthly Runoff at Selected Stations in the Lower Mekong Basin (1000 m^3/sec)



Source: Lower Mekong Hydrologic Yearbook, Vol.1, 1970

TABLE II.2

AVERAGE ANNUAL FLOW OF THE MEKONG RIVER

Station	Annual Runoff (million $m.^3$)	Annual Peak flow ($m.^3/sec.$)	Low flow ($m.^3/sec.$)
Chiang Saen	89,870	10,700	639
Luang Prabang	132,510	16,600	...
Vientiane	144,540	16,300	1,004
Thakhek	241,530	26,100	...
Mukdahan	263,760	29,200	...
Pakse	301,850	39,000	...
Stung Treng	450,310	52,700	...
Kratie	452,890	53,000	1,764
Phnom Penh a/	428,530	43,700	...
Phnom Penh b/	512,000	50,000	...
Outlet Mekong and Bassac b/	550,000	44,000	...

a/ Channel flow only

b/ Channel flow plus estimated overbank spill

Source: Report on Indicative Basin Plan, Mekong Committee, 1970

below Kompong Cham, the delta area is still flooded each year by overbank flow from its six distributaries. On the other hand, at the period of low flow, a large area of the lower delta is affected by salinity intrusion from sea-water.

As Table II.2 shows, the mainstream receives its greatest increments in volume of flow in the section between Thakhek and Stung Treng. The average annual run-off of the Mekong when entering the Lower Mekong Basin at Chiang Saen is some 90 billion m^3. Some 2,500 kilometres downstream the average flow into the South China Sea is in the order of 500 billion m^3. The bulk of this increase in flow comes from the left bank of the Mekong in southern Laos where the Annamite Mountains are subject to high annual rainfall. In fact the actual channel flow at Kratie after the confluence of the Se Kong and Se San rivers is greater than at Phnom Penh and in the delta as a result of the flooding in the lower course and the moderating effect of the Great Lake. It is true that the Thakhek-Stung Treng stretch of the river also sees the entry of the waters from the Khorat Plateau drainage system on the right bank of the Mekong, but even so the contribution of the left bank tributaries is overwhelming. According to an IBRD study

> " With an average unit run-off of 1,100 mm., rising to over 2,000 mm. in the case of some tributaries, the area on the left bank contributes nearly 90% of the increased flow from less than 60% of the drainage area. In contrast, the Nam Mun, the major tributary of the right bank, which

Cont...

> drains a large area of Northeast Thailand, has a run-off of about 200 mm. or only one-tenth of the run-off of the left bank tributaries." 34

The tributary streams follow much the same flow pattern as the Mekong itself and as a consequence tend to worsen the problems of the main stream. When the water level in the mainstream reaches its peak, it is unable to receive all the water from its tributaries and these then flood the surrounding areas. This is the case with most of the streams which eminate from northern Laos and the mountains of Annam, all of which drain to the Mekong. From the north the most important streams are the Nam Tha and the Nam Ou, which reach their maximum flow at the same time as the Mekong in September. Below Vientiane, the Mekong is joined by a series of left bank tributaries, the Nam Ngum, Nam Ca Dinh, Se Bang Fai, Se Bang Hieng, Se Done and Se Kong, all flowing out of the Annamite mountains. Where the rainfall is increased by typhoons affecting the central part of Republic of Viet-Nam, these tributaries help to maintain the level of the Mekong for a longer period.

The whole of the Northeast region of Thailand drains to the middle course of the Mekong. On the northern and eastern part of the Khorat Plateau, there are a number of short tributaries, the Nam Songkhram, Nam Gam and Huai Bang Sai, flowing out of the line of low hills known as the Phu Phan. The whole

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34. I.B.R.D., "A Review of Land and Water Resource Development in the Lower Mekong Basin", 1972, p.23.

of southern two-thirds of the region is drained largely by two main rivers, the Nam Mun rising in Nakorn Ratchasima province and its major tributary the Nam Chi, rising from Chaiyaphum. The Nam Chi flows sluggishly in a southeastward direction for about 765 kilometres and the Nam Mun in an easterly direction for more than 600 kilometres[35] before they join together in Ubon province to meet the Mekong at Ban Dan on the Lao frontier. The gradients of these two rivers are extremely low compared to the other tributaries of the Mekong and they have a relatively small run-off. This may result from the high percolation rate through the Khorat sandstones as well as the rather low rainfall. Nevertheless, during the flood period, water does spill over the banks of both the Mun and Chi rivers with extensive flooding on either bank; this is particularly severe at the confluence of the two rivers in Ubon province. Moreover, as Pendleton has noted

> " The lower course of rivers which flow directly into the Maekhong (Mekong) are especially endangered by too deep and too sudden flooding. Autumn high water in the Maekhong backs up these rivers and floods the valleys for long distances upstream." [36]

This too is a danger in Ubon province.

In the Mekong lowlands, apart from the tributaries from the Annamite Chain, the Se Kong, Se San and Sre Pok, which have much the same characteristics as the tributaries further upstream on the left bank, the Mekong receives the water of its major feeder,

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35. Royal Institute of Arts and Sciences, Bangkok, op.cit., pp. 46 and 49.

36. Pendleton, op.cit., p.138.

the Tonle Sap, at Phnom Penh. The Tonle Sap drains the whole of the Cambodian lowland and its surrounding mountains and through the regulator of the Great Lake moderates the very irregular flows of its tributaries. Of these the Stung Battambang and the Stung Pursut descend from the steep slopes of the Cardamom Mountains in the west and the Stung Sen and Stung Chinit drain the central part of the country to the Tonle Sap River; the Prek Thnot drains from the Elephant Mountains into the Bassac River; in the rainy season all overflow their banks and cause flood damage in their lower reaches.

The main feature of the drainage of the Mekong lowlands, is, however, the Great Lake. This acts as a natural reservoir for the waters of the Mekong in the height of the flood season, causing a reversal of the dry season flow from the lake towards the Mekong.

> " The water level in the Tonle Sap (Great Lake) is closely dependent on the regime of the Mekong. At low water, from November to June, the lake drains into the Mekong; but at high water, from June to October, the direction of flow is reversed, owing to the great height of the river at this season.
> At low water, Tonle Sap covers 2,700 sq.km., measuring 160 km. in length and 35 km. at its widest point ..... In the period of high water, the lake floods the adjacent plains and increases its area to 10,000 sq.km. It becomes over 300 km. in length and in some places 100 km. wide. At some points the depth of water on the flood plain is as much as 14 m." 37
> (See also Figure II.5d.)

The major hydrological feature of the Delta of the Mekong River is its annual flood. Large areas are flooded by overbank flow in the monsoon season,

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37. Naval Intelligence Division of the Admiralty, op.cit., pp. 22-23.

stretching inland from the coast to cover about 70,000 km^2. of delta and lowland between Kompong Cham and South China Sea in the Khmer Republic and in Vietnam.[38] Throughout silt is deposited along the banks of the streams as the velocity of the flood flow is reduced. Everywhere the very flatness of the delta causes a drainage problem as the flood recedes.

If, however, the flood flow causes problems, so indeed does the period of low flow, when the intrusion of the tides brings an increase of salinity to the rivers and canals in the lower part of the delta and as far upstream as Phnom Penh. Figure II.6 shows the extent of this salinity intrustion in the Mekong Delta. Although the subsequent rains flush out the saline accumulations in the soil over wide areas, there are still some localities where the residual salinity is sufficiently high to depress crop yields.

The physical environmental conditions described above have an important effect on the distribution and nature of human activities in the Lower Mekong Basin. Population is unevenly distributed throughout the region, with the density relatively light in the uplands and high in the lowland areas along the banks of the Mekong and its major tributaries. These lowlands are composed mainly of fertile alluvial soils, ideal for wet rice cultivation, although farmers have to make allowances for varying flood conditions. Locally particular problems produce lower densities of habitation. The variation in the size of the Great Lake between the wet and dry seasons limits settlement along the banks

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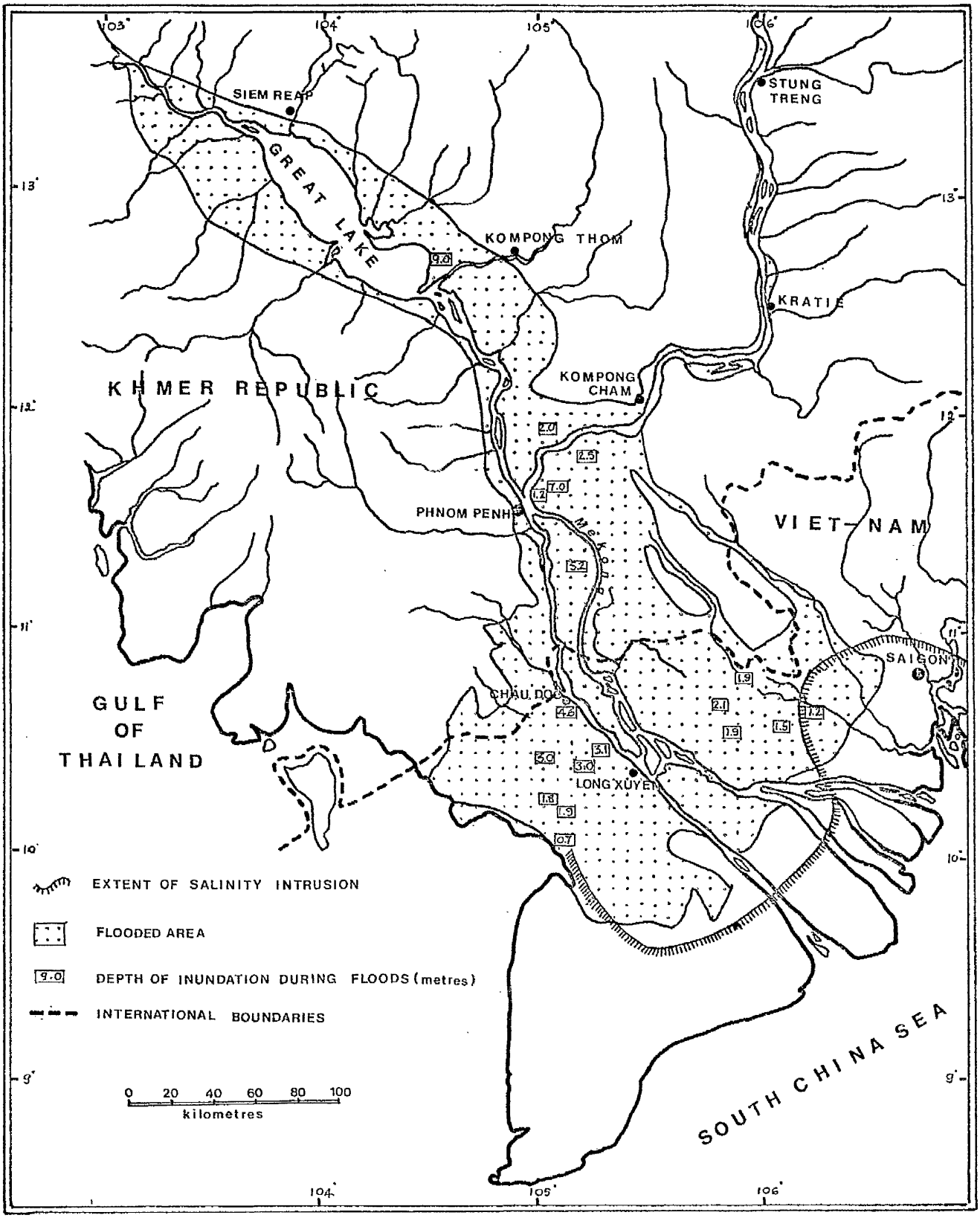
38. UN/ECAFE/Mekong Committee, 1970, op.cit., p.IV-60.

Figure II.6: Extent of Flood and Salinity Intrusion in the Mekong Delta



Source: Development of Water Resources in the Lower Mekong Basin, Flood Control Series No.12, UN/ECAFE, 1957

because of the seasonal flooding and in the coastal section of the delta the high salinity of the soil makes it unsuitable for agriculture.

On the whole, however, the relatively high population densities and intensive agriculture of the Mekong delta and lowlands, including the major valleys within the Khorat Plateau region, contrast sharply with the characteristics of the upland and mountain zone. Here the soils are generally acid, being leached of their basic minerals, although on the Khorat Plateau there are notably saline areas. Except for the limited areas which have been noted above, they are shallow and infertile soils. Malaria is also prevalent in the upland zone. As McCune supports,

> "The high incidence of malaria in the hilly and mountainous areas acts as a major control over population distribution and human efficiency in Indochina." 39

Heavily forested, with steep slopes, the uplands of the Basin are characterised by a quite different form of agricultural activity, the extensive shifting cultivation type.

Whatever the nature of the agricultural enterprise practised in the various parts of the Basin, agriculture is intimately affected by the climatic regime. Temperature poses no constraint, but the strongly seasonal, yet highly unpredictable rainfall pattern cannot be discounted. Its erratic timing and quantity cause the farmers to make elaborate precautions

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39. McCune, Shannon, "The Diversity of Indochina's Physical Geography", Far Eastern Quarterly, Vol. VI, No. 4, 1947, p.343.

against crop failure and agricultural practices in the Basin are closely related to local rainfall and drainage conditions. The traditional agricultural systems of the Lower Mekong Basin and their local adaptations will be described in more detail in the following chapter.

CHAPTER III

THE TRADITIONAL ECONOMY OF THE LOWER MEKONG BASIN

The physical conditions described in Chapter II have had a very important effect on the character of the human activities within the Lower Mekong Basin. The traditional economy has developed in the different parts of the Basin in a manner carefully adapted to the various environmental hazards which confront man. Some parts of the Basin, notably the Mekong Delta itself, have posed problems to settlement which could not fully be solved by the traditional technology of the people of the Basin; the development and population of this area on a large scale awaited, indeed, the arrival of the Europeans and their skill in engineering in the nineteenth century. Elsewhere, the environmental problems have not been so serious and man has occupied extensive areas of the Lower Mekong Basin from the very earliest times.[1]

In the Lower Mekong Basin, agriculture is the dominant economic activity and economic growth in each of the four riparian countries remains primarily dependent upon the growth of agricultural output. Agriculture still makes the largest contribution to GDP of any economic sector. In the Khmer Republic, for example, the average percentage contribution by the agricultural sector to GDP over the period 1965-69 was maintained between 38-40%.[2] In the Northeast region

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1. UN/ECAFE/Mekong Committee, "Archaeology and the Mekong Project", 1973.

2. UN/ECAFE/Mekong Committee, "Annual Statistical Bulletin", 1972, table 12.3, p.40.

of Thailand, the agricultural sector has shown a growth rate of 5% between 1961 and 1969 and in no single year in that period has its contribution to GDP fallen below 44%.[3] In the case of the Republic of Viet-Nam agriculture has consistently accounted for about 32% of the GDP of the country between 1962 and 1968.[4] For Laos it is difficult to obtain up-to-date and reliable information on this matter, but it is estimated that in 1964 agriculture provided 58.9% of the total GDP and in 1965 some 45%.[5]

The importance of agriculture may equally be seen in the fact that the majority of the population is engaged in agricultural activity. Table III.1 shows the dominant place of agriculture both within the total population and within the economically active part of that population within each of the four riparian countries. In the four countries as a whole, more than 70% of the population is engaged in agriculture, while in Laos the proportion reaches as high as 78% in 1970. (Table III.1).

Agricultural produce also dominates the exports of each country within the Lower Mekong Basin. Among these agricultural products, rice is much the most important export crop; Thailand ranks among the top three rice exporting nations of the world in a normal

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3. N.E.D.B., "Gross Domestic Product- Northeast Thailand 1960-1969", 1971, table 34 and 36, pp.58-59 and 62-63.

4. UN/ECAFE/Mekong Committee, 1972, op.cit., table 12.3, p.40.

5. UN/ECAFE/Mekong Committee, "Annual Statistical Bulletin", 1969, table 12.3, p.37 and special table F.2, p.65.

TABLE III.1

ECONOMICALLY ACTIVE POPULATION IN AGRICULTURE

(in thousands)

		Khmer Rep.	Laos	Thailand	Viet-Nam, Rep.
Total population	1960	5,440	2,330	26,392	14,100
	1970	7,102	2,985	36,161	17,952
Agricultural population	1960	4,455	1,939	22,103	11,238
	1970	5,426	2,337	27,663	13,338
Economically Active Population					
Total	1960	2,314	1,279	13,538	8,145
	1970	2,933	1,567	17,756	9,246
In agriculture	1960	1,895	1,064	11,342	6,494
	1970	2,241	1,227	13,583	6,870
Percent in agriculture	1960	81.9	83.2	83.8	79.7
	1970	76.4	78.3	76.5	74.3

Source: F.A.O. Production Yearbook, 1972

year and until production was disrupted by warfare both the Khmer Republic and the Republic of Viet-Nam exported substantial quantities of rice. In addition, rubber has been an export of continuing importance to the economies of both the Khmer Republic and the Republic of Viet-Nam, while Thailand's Northeast region contributes substantially to the country's exports of maize, cassava and especially kenaf.[6]

Two distinct systems of cultivation have characterized the traditional economy of the Lower Mekong Basin. Most widespread today is the practice of rainfed lowland wet rice cultivation which continues to provide the subsistence base and also an important source of cash income to the great majority of the farm families. Wet rice cultivation has been extended throughout the Basin wherever the rainfall and the topography have allowed. Of major importance, however, are the broad river valleys of the Mun and Chi rivers in the plateau of Northeast Thailand, the lands surrounding the Great Lake in the Khmer Republic and the Delta of the Republic of Viet-Nam.

Throughout the Basin, the cultivation of wet rice is generally carried out under rain-fed conditions. In only a few limited areas, notably in Chiang Rai province of Northern Thailand, have traditional methods

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6. According to Ingram "Economic Change in Thailand 1850-1970" 1971, table XXVI, p.260, during 1965-67, 10.19% of maize area, 98.18% of kenaf and 9.91% of cassava was in the Northeast region.

of irrigation been practised, but some areas of paddy cultivation do rely fundamentally upon local flooding. This is particularly the case along the lower course of the Mekong itself from about Kompong Cham in the Khmer Republic down to the South China Sea, where cultivation practices are adapted to cope with the deep flood conditions.

Because of the great reliance on rainfall in agriculture the main crop-growing seasons correspond closely to the seasonal rainfall patterns. Agricultural production is highly seasonal, reflecting the monsoonal rainfall regime and it can be subject to wide year-to-year fluctuations. In some parts of the Basin, the rainfall during the rice-growing period from about June to December or January is only just sufficient to meet requirements and there is a definite shortage in some years of irregular rainfall. In the Northeast region of Thailand, 85% of the annual rainfall occurs during the wet season and in poor years there can be a serious shortage of water in the dry season. In such years, not only is water unavailable for agricultural purposes, but domestic water supply is also threatened.[7]

Where the water supply is wholly inadequate for wet rice cultivation or where, in the remote upland areas, slope angle and soil deficiencies pose other difficulties, the traditional system of shifting cultivation can still be found. Under this 'swiddening' system, the main crop may equally be rice, but in places unsuitable even to hill rice strains, a variety of other

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7. Ng, Ronald C.Y., "Some Landuse Problems of Northeast Thailand", Modern Asian Studies, 4,1, 1970, p.24.

crops may be grown, with maize or various root crops usually forming the subsistence base.

It is now proposed to consider in turn these two traditional systems of cultivation within the Lower Mekong Basin. Their relative importance will be assessed and the particular cultivation practices described. Attention will drawn to any regional differences in methods of cultivation as they are adapted to the varying physical conditions within the Basin.

Shifting Cultivation

Traditionally shifting cultivation has been the dominant agricultural system of the upland areas and of the drier parts of the lowland in the Lower Mekong Basin. It has been particularly important amongst the hill tribe peoples inhabiting the more remote areas in Northern Laos, on the Moi Plateau, in the Dong Rek Mountains between Northeast Thailand and the Khmer Republic, along the eastern frontier hills of the Khmer Republic and in the adjacent Central Highlands of the Republic of Viet-Nam. In Laos particularly, the Khmu, Lamet, Meo and some upland Lao groups, comprising perhaps half the total population, have relied primarily upon this system of cultivation.[8]

The practices of shifting cultivation are well-known and it may be characterized by its other name of

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8. Halpern, Joel M., "Aspects of Village Life and Cultural Change in Laos", 1958, p.24.

'slash-and-burn'. The upland forest is cut down and burned in the dry season, starting in December or January. A piece of land is selected for cropping and the dense underbrush and the heavy forest trees are cut down and spread out. The leaves, branches and other material are left to dry for a period, although the major tree-trunks may be used by the cultivating family. After a second period of clearance has been carried out, the burning begins around mid-May. No effort is made to remove all the stumps or the major logs and these are burnt in situ.

When the rains begin in June, the cultivators wait until the ground is moistened before planting, usually by July. The field is not ploughed and the seeds are simply planted in holes dug or poked with a bamboo stick or a similar iron-tipped tool. It is the usual practice for the man to make the hole with his dibble-stick, while the woman of the family follows, dropping a few seeds in each hole and covering them over with her foot.

After planting, at least in the first year of cultivation the field requires little attention. The ashes of the forest contain sufficient nutrient material for a shallow root crop, so extra fertilisation is not necessary. In the first year of cultivation weeding is not necessary, but weeds tend to become a major problem in the second and subsequent years, leading finally to the abandonment of the field. Then two or three weedings are normally carried out at different periods of growth of the crop.

For upland rice cultivation, quick maturing

varieties are generally used since the clearing of land and the subsequent harvesting take quite a long time and the length of the rainy season is highly variable. Most paddy is ready for harvesting in three or four months depending on the variety grown. Harvesting practices for this hill rice are similar to the methods practised in lowland rice cultivation, although in some remote areas of northern Laos harvesting by plucking the heads of the rice is still practised.[9] Threshing is likewise carried out in much the same manner as in the lowlands. The agricultural year ends with the storage of the crop and the process of clearing begins again in January.

It has been normal to crop a particular plot for up to three years, after which it is abandoned and allowed to lie fallow for up to twenty years. After the abandonment, the cultivating family move on to clear a new plot from the forest. In practice it is quite frequent for plots to be abandoned at the end of the first or second years of cultivation because of weed encroachment or impoverishment of the soil. The yield from swidden cultivation is generally high in the first year of clearance, but it declines rapidly after this. Moreover, shifting cultivation is completely dependent on rainfall and in dry years the farmers can face severe famine.

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9. Ibid., p.22.

Swidden farming is practised for the cultivation of dry upland rice, both as a main crop and as a supplement to wet rice cultivation. In addition a variety of other crops are grown. In Laos, corn, tobacco, vegetables and opium are the major crops grown under this system. The cultivation of opium extends the life of individual plots and amongst the Meos, opium fields are known to have been worked for up to twenty years, although the average life is much shorter.

Even among the Laotian hill tribes, however, the practice of shifting cultivation has been in decline in the last few decades. By its very nature, shifting cultivation is an extensive type of land use that is well suited to mountainous areas with a sparse population. Dobby supports that it is particularly well adapted to those areas where soils are poor and where the danger of erosion is extremely high.[10] Where population begins to increase rapidly, however, severe pressure is put upon the system of shifting cultivation. As the cycle is shortened the forest is not allowed to regenerate properly and the soil becomes exhausted of nutrients and susceptible to erosion.

The system has come under pressure both in the remote hills and in the land outside the river valleys in the lowlands. In the hills, increases in population have been accompanied by the insecurity of warfare, both in northern Laos and in the Central Highlands of

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10. Dobby, E.H.G., "Southeast Asia", 1967, p.348.

the Republic of Viet-Nam. This has tended to reduce the amount of land available for the practice of shifting cultivation and a large number of the hill peoples have left for the relative security of the lowlands where they have taken up a more permanent form of cultivation. More significant has been the movement away from shifting cultivation in the lowland fringes. Increased demand for land from the lowland cultivators, particularly with the growth of cash crop cultivation has reduced the viability of swiddening.

It is clear that shortly after World War II swiddening was still an important practice in both lowland Laos and in the Khorat Plateau of Thailand, As late as 1956, Kaufman could comment that approximately 20% of the Lao farmers in the Vientiane area relied on swidden farming.[11] For Thailand, Dobby notes that

> "Probably, almost a million Thai people in the northern and western mountain districts and on the Korat Plateau still regularly depend for their food on shifting cultivation, The amount of land used is probably half a million acres in any one year." 12

Other writers like Platenius have noted that the initial expansion of kenaf cultivation in the Khorat region was on the basis of shifting cultivation, but observation suggests that this is certainly not the case today. Although statistics are generally absent,

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11. Kaufman, Howard K., "Village Life in Vientiane Province 1956-57", p.4.

12. Dobby, op.cit., p.270.

it is certain that in both lowland Laos and in Northeast Thailand shifting cultivation is no longer a major component of the whole agricultural system. Indeed, of the total area under paddy cultivation in Northeast Thailand in 1970, only 1.96% was under hill rice.[13]

Lowland Wet Rice Cultivation

Although upland rice cultivation forms an important part of the total area cropped under the system of shifting cultivation, it is in lowland wet rice cultivation that the basis of agriculture in the Lower Mekong Basin lies. Rice is practically the universal subsistence crop within the Basin and under a system of sedentary cultivation it can support much higher densities of population than under the swidden system. As the most important subsistence crop, in an only slightly commercialized economic system it dominates the agricultural land-use pattern of the area.

The total quantity of water required for the successful cultivation of wet rice varies from 40 to 100 inches per year,[14] according to the length of the growth of the particular variety, the soil in which it grows and the season of growth. Almost everywhere in the Lower Mekong Basin rice cultivation is completely dependent on rainfall, but in most places this is

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13. Thailand, Ministry of Agriculture, "Agricultural Development Plan, Northeast Region 1972-1976", 1971, Appendix, table 4-5.

14. F.A.O., "Report of the FAO Mission for Siam", 1948, p.29.

sufficiently abundant for its growth. On the other hand, it cannot be said that in some parts of the Basin, rice cultivation is necessarily the most productive crop, or even the most productive subsistence crop. Keyes indeed states that

> "..without proper water control, wet rice cultivation is not the most productive form of agriculture for the area despite the fact that it accounts for the largest percentage of land under cultivation." 15

The disadvantage of depending entirely upon rainfall is that there may not be rain when water is needed or that there may be too much when it is not needed. In some parts of the Basin, owing to the lack of drainage facilities, heavy rainfall can bring about excessive floods, causing damage to the rice plants. Drought is equally detrimental to the rice crop and the extent to which the area planted is damaged is the main factor responsible for fluctuations in total paddy production.

In each of the countries of the Lower Mekong Basin, paddy dominates the cropping pattern. In the Northeast region of Thailand, 75% of the total farm area was given over to rice in 1970.[16] In the Khorat region, the productivity of rice cultivation is relatively low when compared to the other regions of Thailand, partly as a consequence of the high evaporation rates and partly because of the highly permeable sandy soil as noted earlier. Nevertheless the Northeast remains the

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15. Keyes, Charles F., "Isan in a Thai State", 1965, p. 81.

16. Thailand, Ministry of Agriculture, 1971, op.cit., table 4-5.

second largest rice growing area in the country. The main areas of rice production are along the valleys of the Nam Mun and its chief tributary the Nam Chi.

The rice fields of the Northeast region can suffer equally from drought and flood. As was seen above, the monsoon rainfall of this region is particularly variable in both amount and timing from year to year. During the period of the heaviest rain, from May to September, the broad, flat valleys of the Mun and Chi rivers are often inundated, especially when the Mekong itself is in high flood and tends to dam back the water of the Mun system. Outside the river valleys, drought is perhaps a greater problem, for the effectiveness of the marginal rainfall is reduced by the agency of the permeable sub-soil. Farmers expect a degree of crop damage almost every year and it is quite common for one part of the region to be affected to the extent that the crop cannot be harvested or even planted. Table III.2a and b shows the percentage of the rice planted area lost in the Khorat region by province over the period 1965-1971.

Subsistence farming is also the basis of the economy of the Republic of Viet-Nam and rice growing is the most important agricultural activity. Under peaceful conditions, about 80-85% of the cultivated area is devoted to rice and about 85% of the population is engaged in rice farming. It was noticeable, however, that in 1967 only 60-65% of the population were so employed.[17] The Mekong Delta is the main rice growing

17. Tran Quang Minh, "Agricultural Development in Viet-Nam", The Vietnam Council on Foreign Relations, undated, p.5.

TABLE III.2 (a)

PERCENTAGE OF RICE PLANTED AREA DAMAGED BY FLOOD

NORTHEAST THAILAND, 1965-1971

Province	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72
Nongkhai	0.1	76.9	-	-	10.2	22.3	53.5
Loei	0.3	0.8	-	-	-	-	0.6
Udon Thani	0.2	8.7	-	-	0.7	4.0	2.5
Sakon Nakhon	0.1	4.0	0.3	-	2.5	11.5	0.9
Nakhon Phanom	1.8	11.5	-	-	1.4	13.3	6.8
Kalasin	0.1	2.7	-	-	0.8	5.0	-
Khon Kaen	0.3	0.2	0.1	0.1	3.9	0.3	-
Chaiyaphum	-	1.3	0.3	-	8.7	0.3	-
Nakhon Ratchasima	2.3	0.5	0.6	0.1	0.6	-	0.1
Maha Sarakham	-	-	-	-	9.0	0.2	0.1
Roi Et	0.5	2.7	0.5	3.3	1.7	0.5	0.7
Ubon Ratchathani	0.6	3.3	-	1.9	-	0.2	1.3
Si Sa Ket	0.2	3.7	0.2	0.1	0.1	0.6	-
Surin	-	2.0	0.1	0.1	0.1	-	-
Buriram	5.0	0.3	2.2	0.1	0.3	-	-
Total	0.7	4.9	0.3	0.6	2.2	2.6	2.3

Source: Annual Rice Report, Thailand.

TABLE III.2 (b)

PERCENTAGE OF RICE PLANTED AREA DAMAGED BY DROUGHT

NORTHEAST THAILAND, 1965-1971

Province	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72
Nongkhai	3.8	1.5	9.6	0.9	-	-	-
Loei	0.2	0.8	8.4	0.8	0.4	-	-
Udon Thani	0.9	0.7	12.6	0.7	0.1	-	0.2
Sakon Nakhon	17.5	0.4	0.1	0.1	0.1	-	-
Nakhon Phnom	2.7	3.2	2.8	0.4	-	-	-
Kalasin	11.2	0.2	5.9	3.1	0.1	-	-
Khon Kaen	35.8	0.3	53.5	6.3	4.5	3.6	0.7
Chaiyaphum	19.8	1.1	14.2	17.4	0.2	-	0.5
Nakhon Ratchasima	9.5	2.1	31.1	38.5	1.1	4.4	1.6
Maha Sarakham	21.1	-	13.8	0.1	-	8.3	-
Roi Et	6.6	1.1	7.8	8.0	2.0	2.3	0.2
Ubon Ratchathani	1.8	0.4	7.7	6.4	0.4	0.1	0.1
Si Sa Ket	10.8	0.4	10.2	4.8	1.5	0.6	-
Surin	27.9	-	15.4	4.7	0.1	1.2	-
Buriram	40.5	0.1	17.6	14.7	0.2	1.2	0.3
Total	12.5	0.7	13.7	8.2	7.9	1.6	0.3

Source: Annual Rice Report, Thailand.

area, with 67% of the total planted area and some 68% of the country's production over the period 1961-71.[18] It is a rich alluvial region which is affected by the annual overflow of the Mekong River during the wet season. It only became possible to cultivate the Delta towards the end of the Nineteenth century when floating rice was introduced and after the area became the French colony of Cochin-China, it was developed with an emphasis on agriculture with the construction and re-construction of dams and drainage channels.[19] The fertility of the soil and the adaptability of the typical rice varieties of the region make the Delta of the Mekong in the Republic of Viet-Nam the area with the highest yields in the whole of the Lower Mekong Basin, with the exception of Chiang Rai province in Northern Thailand.

Throughout most of the colonial period, Cochin-China was a major rice-exporting region and independent Republic of Viet-Nam retained this status until 1965. Since that date, however, the Republic of Viet-Nam has become a large-scale importer. Since 1965, overall agricultural production fell, according to official estimates, about 15-20% and the most serious problem has been the reduction in rice production.[20] As a

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18. Mekong Statistical Bulletin, 1972, table 3.6,p.16.

19. Fisher, C.A., "South-east Asia, A Social, Economic and Political Geography", 1964, p.539.

20. Embassy of Viet-Nam, London, "Viet-Nam, Yesterday and Today", vol. 6, no. 9, Oct. 1972, p.12.

result of the Indochina war, large areas of the Mekong Delta, before 1939 the world's third largest rice-exporting region with a potential rice production greater than that of either the Irrawaddy delta or the Chao Phaya plain, have been devastated or have fallen out of production.

Rice is equally the principal crop of the Khmer Republic, taking up some 83% of the total cultivated land in 1970.[21] Although rice is grown in every province, the chief producing areas are Battambang and Siemreap on the shores of the Great Lake and Kompong Cham and Prey Veng in the flood plain of the Mekong and its tributaries. The latter area is subject to severe flood problems even though floating rice is widely grown, whereas in Battambang and Siemreap the paddy is often damaged by drought. During 1968-69 about 20% of the total paddy area of the country was damaged by drought and in some provinces, Battambang and Kompong Thom for example, more than 50% of the planted area was affected. Table III.3 shows that drought damage is a significant factor in most years in the Khmer Republic.

Rice has been a major export of the Khmer Republic from the French colonial period right up to recent years. It has only been the country's involvement in the Vietnam conflict and the increasingly unstable political situation since 1969 which have brought about a decline in exports to a very restricted level. The insecurity

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21. Calculated from F.A.O., "Production Yearbook", 1972, p. 5 and Mekong Annual Statistical Bulletin, 1972.

TABLE III.3

PERCENTAGE OF RICE PLANTED AREA DAMAGED BY DROUGHT:

KHMER REPUBLIC, 1966-69

Province	1966/67	1967/68	1968/69	1969/70
Battambang	20.4	14.1	50.1	4.4
Siemreap	25.8	1.2	11.8	0.2
Phreah Vihear	-	-	-	41.0
Stung Treng	34.5	-	19.7	-
Ratana Kiri	-	-	0.4	1.0
Pursut	22.1	3.2	5.0	0.4
Kompong Thom	33.8	-	51.9	5.0
Kratie	18.5	-	3.1	-
Mondolkiri	-	-	4.0	-
Kompong Chhnang	10.5	2.0	7.0	0.5
Kompong Cham	15.2	4.1	4.0	0.4
Kompong Speu	-	5.8	23.0	7.0
Takeo	35.2	0.5	6.4	0.7
Kandal	14.9	14.7	29.2	3.0
Prey Veng	41.8	14.6	6.0	0.2
Svay Rieng	7.5	1.1	0.1	-
Total	22.2	6.7	20.2	2.3

Source: Annual Statistical Bulletin, Mekong Committee, various issues.

within the country combined with a bad drought in 1972 meant that exports were finally halted in that year.

Like the other three countries, the traditional economy of Laos is primarily based on subsistence crops, the most important of which is rice. Here upland rice cultivation is probably rather more important than in Thailand, Vietnam or the Khmer Republic and the only extensive areas of wet rice cultivation are to be found along the Mekong river. The plains surrounding Vientiane, Luang Prabang, Savannakhet and those of Champassak province are the main producing regions. Traditionally the north of the country has been an area of rice deficit, while there has usually been a surplus in the south. This does not amount to a position of self-sufficiency however, and rice is usually imported from Thailand. The rice-fields along the Mekong are particularly vulnerable to flood damage; during the flood of 1966 for example, production was reduced to just 680,000 tonnes compared to the previous year's crop of 727,000 tonnes.[22] Laos is the only country of the Lower Mekong Basin which was not traditionally a rice exporter. The almost annual contest for control of the country has led to the abandonment of considerable areas of paddy and the rice-deficit situation has now been made worse.

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22. Mekong Annual Statistical Bulletin, 1972, table 3.6, p.16.

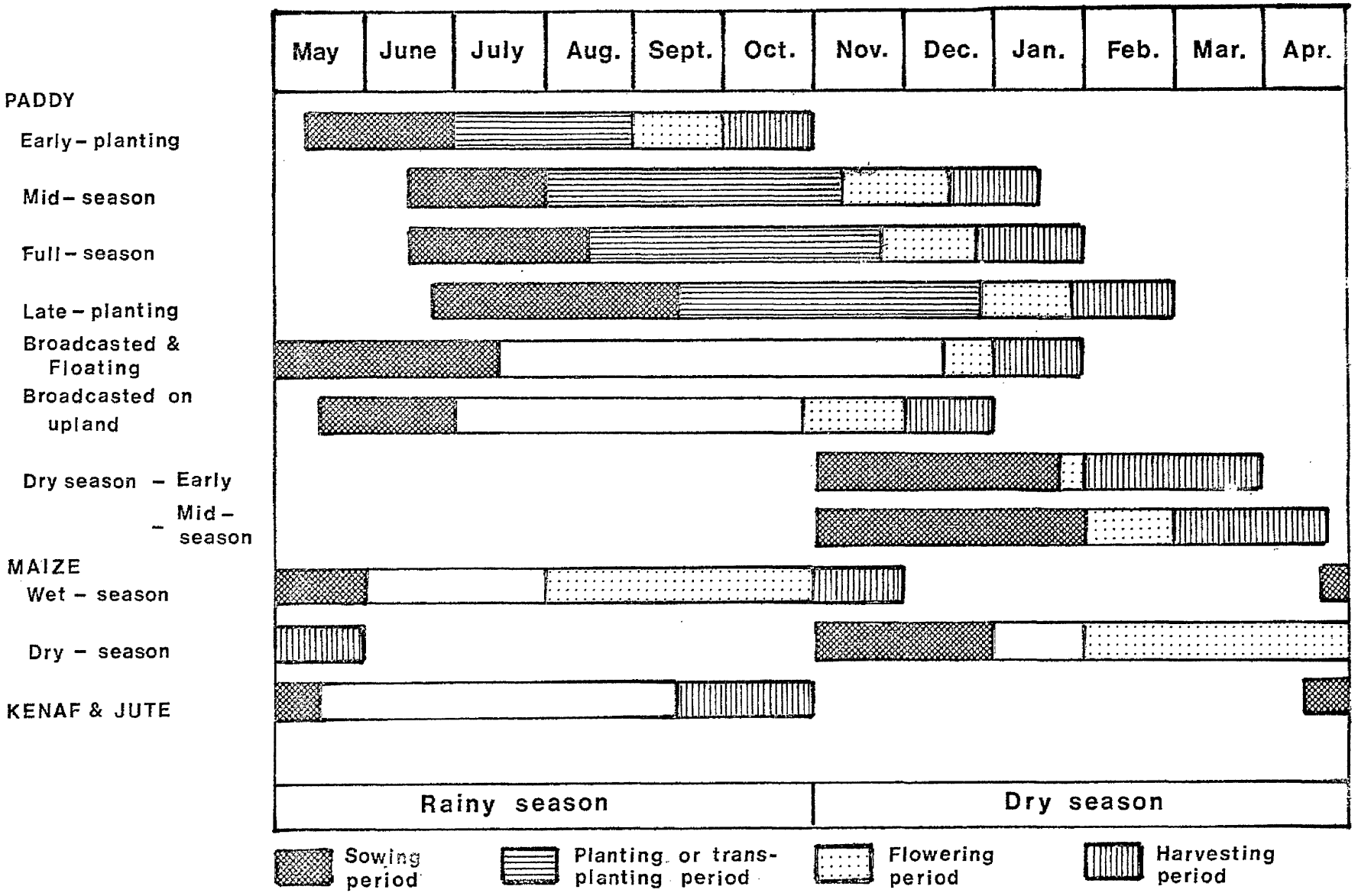
The Traditional Practices of Wet Rice Cultivation

The traditional practices of wet rice cultivation in the Lower Mekong Basin have been developed over many hundreds of years. Almost everywhere a single crop of rice is grown over the six-seven month period of the rainy season; only where there is a particularly favourable water supply, like along the Mekong river and its distributaries in the Delta, can a second crop be contemplated after the rice harvest. Figure III.1 presents an idealised representation of the yearly agricultural cycle. The actual timing of the individual processes depends however on the water supply situation and the arrival of the rains can vary considerably from year to year. Indeed, depending on the time of arrival of the rains farmers may vary their cultivation practices to suit the particular conditions.

Just as the cultivation practices may vary in a single location from year to year, so too is there a considerable variation in the different parts of the Basin. In each area, the individual farmers attempt to insure themselves in the best way possible against crop failure according to their individual interpretation of the various environmental hazards. These adaptations may take the form of organization of the available land and labour resources in a particular way or may involve the cultivation of particular varieties of rice so as to guard against crop loss.

Despite these various differences, the traditional methods of wet rice cultivation in the Lower Mekong Basin are essentially similar. Before discussing the particular adaptations therefore, a description

Figure III.1 Yearly Crop Cycle



Source: Agricultural Statistics Yearbook, Republic of Viet-Nam

will be given of the standard practices of cultivation as followed in the area as a whole.

Lowland rice cultivation may be broadly divided into six processes, namely

(1) Land and Soil Preparation
(2) Rice Nursery Culture
(3) Planting
(4) Cultivating
(5) Harvesting
and (6) Threshing and Storage

(1) Land and Soil Preparation

The method of land preparation is largely determined by water supply, soil type and the method of planting. Farmers begin to prepare their land with the first rains of the season. As soon as the soil is slightly moistened, ploughing may begin, sometimes as early as April. Over large areas of the Basin, particularly in the areas of greater relief, the paddy fields are divided into small plots each surrounded by small embankments to hold and control the water. At this early stage in land preparation, it is usual to renew these embankments. Where stubble still remains in the field after the previous harvest, it may first be burnt off before the initial ploughing is carried out.

Although at the present time tractors have been introduced particularly for this first ploughing in parts of the Basin like Battambang where fields are larger, traditionally ploughing is carried out by

water buffaloes; where the soil is lighter, bullocks may even be used. The plough is a simple implement made of wood, usually with a cast-iron share. It is attached to a simple wooden yoke fitted to the buffaloes. With this home-made plough, the land is turned shallowly to a depth of about three inches.

After the initial ploughing, further preparation awaits the onset of the main rains. When the ground is thoroughly saturated, the paddy is ploughed a second time and then the soil is broken up with the harrow. This has the effect of screening out the larger weeds and breaking up the mud clods. The dead and rotten weeds are harrowed into the soil. The harrow is another simple instrument consisting of a heavy wooden plank fitted with bamboo or iron teeth. After harrowing the farmers seek to level the plot with a buffalo-drawn bamboo pole; this process seeks to facilitate the regulation of water in the fields and to better control the weeds.

After this the land is ready for planting, although it is only with transplanted rice that the full process described above is usually carried out. Broadcast sown paddy and especially floating rice require less painstaking preparation of the land; a single ploughing and harrowing may only be necessary.

(2) Nursery culture

Where rice is to be transplanted, seedlings must first be grown in a nursery bed. Preparation of the nursery is begun again as soon as the early rains

have sufficiently moistened the fields, although it is usual to choose for the nursery land with a good water supply, with good drainage and clearly exposed to day-long sunshine. Where there are dangers of flood, the valuable seed-beds are often raised up.

It is general practice to prepare a seed-bed of about one-tenth of the total paddy area to be planted. The techniques for the preparation of the nursery are similar to those used to prepare the main fields. The seed-bed is ploughed and harrowed, thoroughly puddled and then the work is finished off by levelling the flat mud bed. Animal manure is sometimes applied in the sandy or clay soil to ensure the growth of the seedlings.

Before sowing, the seeds are germinated by soaking them in water for a few days, after which they are broadcast on the muddy surface of the seed-bed. About 65 kilogrammes of seed are used to cultivate one hectare of the paddy.[23] The seedlings are treated with the utmost care. The supply of water to the nursery is carefully regulated at first in order to prevent the growth of a vigorous deep-rooting system. After about two weeks, the water in the seed-bed is gradually raised as the plants grow. This control of irrigation is designed to promote the growth of shallow roots which makes for easy pulling and minimizes breakage.

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23. Sarot Montrakun and Samphot Suwanwaong, "Rice Cultivation" 1971, p.29.

After about 35-45 days in the nursery, the seedlings have grown enough for transplanting, although where water is scarce the period is apt to be longer. The farmers stop the irrigation of the seedbed to prevent the further growth of the seedlings, but if there is an extended period of drought, they dry off and die. This can be an important contributory factor in crop failure.

(3) Planting

In the Lower Mekong Basin two methods of rice planting are practised - broadcasting and transplanting. The methods used in particular areas depend upon the local physical conditions and also on the amount of labour available. Although the transplanting method generally requires a more intensive use of labour, as Grist notes,

> "Experience and experiment in all the more important areas of production in the East confirm that higher yields may be expected from transplanted paddy than from direct broadcasting or drilling." 24

Broadcasting, which does not require the preparation of a nursery-bed as described above, is common in those low-lying areas where flooding is frequent and where water cannot easily drain away as in the Delta of the Republic of Viet-Nam and in parts of the Khmer Republic along the banks of the Mekong and the Great Lake. Here, floating rice which can withstand the great depth of flood water is grown; this has a long,

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24. Grist, D.H., "Rice", 1959, p.121.

brittle stalk and is too fragile to be uprooted. The farmers of these areas broadcast the seeds on the ploughed fields at a rate of about 120 kilogrammes per hectare before the fields are flooded, normally in June or July.[25] Further rain will then break down the soil and mix it with the seeds which have absorbed sufficient water to germinate. The floating rice hereafter grows more rapidly than ordinary rice and is able to keep pace with the rising flood. It is left to grow through the floods and is commonly harvested in December and January when the water begins to recede.

Broadcasting may also be practised in areas where the soil is of low fertility or where holdings are particularly large, for it requires less intensive labour application than does transplanting. On the other hand, transplanting is generally the more favoured practice throughout the Lower Mekong Basin. In the Northeast region of Thailand, for example, in 1970 only 2% of the total paddy area is broadcast sown.[26] In practice, the use of broadcasting is more open to risk. There is no assurance of sufficient rainfall in May and June at the start of the broadcasting period and it is more difficult to maintain the appropriate amount of water over the entire paddy field than over the limited area of the nursery-bed. Thus broadcasting can result

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25. Sarot and Sombhot, op.cit., p.31.

26. Thailand, Ministry of Agriculture, 1971, op.cit., Appendix table 4.

in lower yields than the transplanted rice. Moreover, there is little problem of labour shortage for most of the farm households in the Basin. In general, holdings are sufficiently small to be worked by the nuclear family and when extra labour is required, it has been traditionally supplied by exchange agreements with neighbours and relatives.

Transplanting in the Lower Mekong Basin is usually carried out between June and August, although in some years it may be as late as September. When the seedlings mature and are ready for transplanting, they are pulled up from the nursery, the mud is shaken off the roots and the seedlings are bundled. The tops of the leaves may be chopped off to reduce wind-damage and to make transplanting easier. The seedlings are thrust deep into the mud in rows across the prepared field. Where the soil is particularly heavy or still a little hard, it maybbe necessary to make a small hole with a stick before the seedling is planted. Normally about four seedlings are planted per hill and the distance between the hills is maintained throughout according to the farmers' individual judgement. Two weeks after transplanting the rice plants begin their growth and during this period the depth of water in the paddy varies from 6 inches to one foot.

In areas of high fertility where flooding is not a serious problem, but where the drainage is poor, double transplanting is practised. This is notably in the southern part of the Vietnam Delta. The first transplant is from the seed-bed to the fields where

the seedlings are planted rather densely. Four to six weeks later, they are transplanted again at wider spacing between the hills and with the upper half of the plants chopped. The practice of double transplanting allows for weed control and prevents excessive growth and damage from crabs which are plentiful in the swampy paddy fields.

(4) Cultivating

Under the broadcasting system, little attention is given to the care and maintenance of the paddy, although weeds do compete with the rice in its early stages of growth. Where floating rice is grown, as the depth of the water starts to increase, while the rice grows rapidly in pace with the flood waters, the weeds generally die and decay and indeed provide nourishment to the rice plants.

Where the rice is transplanted, one of the methods of eliminating and preventing the growth of weeds is in the whole process of land preparation. Nevertheless weeds do remain a problem where the land has been poorly prepared or where there is insufficient depth of water. Thus weeding may be carried out once or twice within the month after transplanting. The weeding is done either by hand or with a hoe. In general weeds are not abundant in the paddy, for they cannot exist in the deeply irrigated fields in competition with the rice plants.

Rice diseases are another problem for the farmer and are a significant factor in crop damage. Throughout

the Basin, such diseases as rice blast, stem rot and viruses like yellow-orange leaf, orange leaf and yellow dwarf are widespread. In the Republic of Viet-Nam, it is considered that most crop damage is done by insects and disease.[27] Some of the viruses are not too serious, but in any case the farmers have had little protection against them in the traditional system. Even today, although pesticides are available, they tend to be rather expensive if applied properly.

(5) Harvesting

Harvesting time in the Mekong Basin varies according to the time of planting and according to the varieties grown. Usually, however, it may extend from October through to January and is earliest where a second crop may be anticipated.

Under the traditional system, harvesting has been commonly a co-operative affair with farmers banding together to help one another get in their crop in turn. The old methods are still used. The plants are cut by hand with a short curved sickle about one-third or one-quarter of the distance from the panicle base according to the height of the plants. The stubble remains in the field, but the stalks are tied together in a bundle and are sundried for 3-5 days before being carried to the threshing ground. The stubble is used as buffalo feed in the dry season or may be burned to provide ash fertilizer for the following crop season.

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27. Hickey, Gerald Cannon, "Village in Vietnam", 1964, p.140.

For floating rice, the harvest period is often as late as January. Here the reaping is done from a boat and the stalks are cut about half-a-foot below the water. When the water recedes in the dry season, the stubble is burned off.

(6) Threshing and Storage

Methods of threshing in the Lower Mekong Basin vary widely. Under the treading method, the harvested rice is spread out on the prepared earthen threshing floor and the buffaloes are guided around the floor until the rice grains are separated out from the panicle. In the Republic of Viet-Nam, a variation of this method is also used, the stalks being threshed by rolling a heavy stone over the plants. The advantage of both these methods is that the stalks are softened and made better fodder.

Where threshing is done by hand, the stalks are cut to the base of the plant. The ears of grain are then beaten against the inside of a bamboo basket, or against bamboo rods or a bamboo mat, or against two heavy planks. By this simple method, the grains are separated from the husks.

Winnowing is also carried out by an essentially simple process. The threshed grains are tossed up with a basket or a woven bamboo tray and the immature grain and the chaff is blown away by the wind. Where there is no wind, a bamboo fan is used. Finally, the cleaned grains are stored in the rice barns for seed and home consumption. Any surplus is put in gunny sacks for sale direct to local rice millers or merchants.

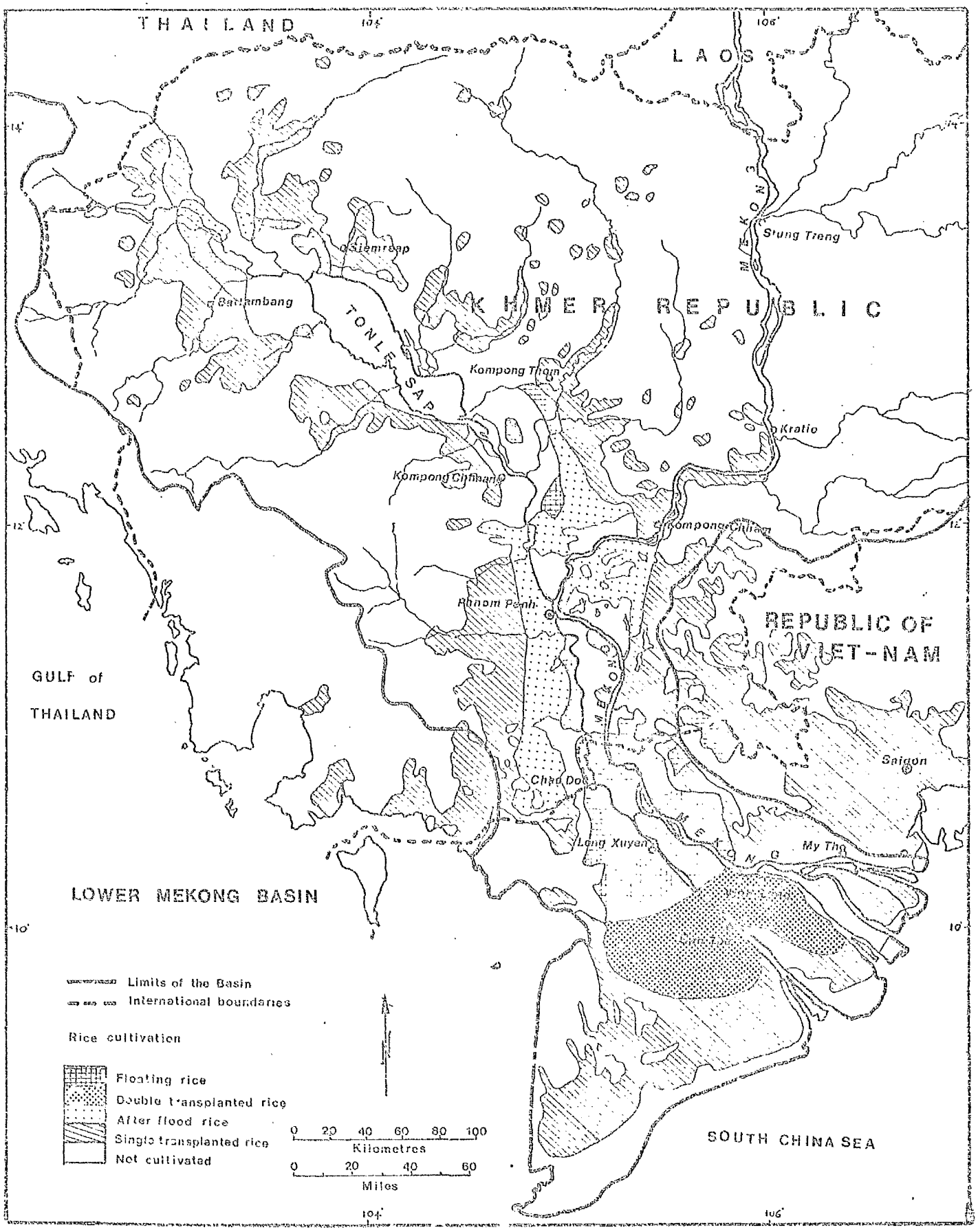
Particular adaptations in Cultural Practices

The typical methods of lowland rice cultivation in the Lower Mekong Basin have been described above. Even such a generalised account, however, demonstrates some of the differences in adaptation to the environment in the various parts of the Basin. It has been noted that, while transplanting is perhaps more widespread in the Basin as a whole, where flooding problems are large, broadcast sowing of rice is a common practice. Where floods are not quite so extreme, moreover, the practice of double transplanting is characteristic. (Figure III.2) Again, where floodwaters are too high for normal rice, the floating variety is grown.

Such adaptations to the physical environment, viewed chiefly in terms of the water control factor, are to be found throughout the Basin on the local scale. Wherever it is possible the farmers of the Lower Mekong Basin have sought to take precautions to ensure their annual subsistence crop. Such precautions have taken one or more of three major forms: a temporary adaptation of the normal cultivation practices may be followed where the rains are unusual in amount and incidence; rice varieties may be selected according to local conditions; organization of land and labour resources on the farm as a whole may be adapted to the local environmental pattern.

The seasonal work schedule may, as noted above, change considerably from one year to the next, depending on the time of arrival of the rains or the main flood period. When the rains arrive late, the various processes of rice cultivation are delayed and the

Figure III.2: Area of Double Transplanted and Floating Rice in the Delta



Source: A Review of Land and Water Resource Development in the Lower Mekong Basin, IBRD, 1972

heavy labour requirements of land preparation and planting are concentrated into a short period. Even on the smaller farms, the supply of labour or of draught animals may not be sufficient to handle all the land. The farmer then has the choice of concentrating his labour on a small acreage or of spreading it thinly to cover as much land as possible, investing less care per unit area. Usually the latter strategy is followed in the hope of salvaging a crop sufficient for subsistence needs. However, this may involve the abandonment of crucial practices like harrowing and levelling with the resulting reduction of water control within the individual plots. Where the rain is particularly late, a farmer whose normal practice is to transplant may abandon this for broadcast sowing when the rains do arrive.

Similar problems may arise when there is a considerable gap between the first showers and the main rains. In these circumstances the farmers may be forced to prepare a second seed-bed and may equally find it impossible to adequately break-up and level the soil hardened after the first ploughing. Where the rainfall arrives in reduced quantity, it may not, of course be possible to prepare some of the land at all, while in extremely heavy rains flooding may force him to a merely speculative broadcast sowing.

A second typical adaptation is in the type of rice grown. There is a wide range of native rice varieties available in the Basin, which vary in quality, time to maturity, straw length and the ability to

withstand rising flood water. All the traditional varieties are of the basic Indica strain. The selection of a particular variety has traditionally depended on the local conditions, the level of the land, the depth and the duration of the water supply and the fertility of the soil, but according to Pendleton

> 'Ancient tradition and the experience of his ancestors lead him to choose the variety suited to his locality.' 28

Such methods of selection often prove to be a rich product of the farmers' intelligence and experience.

Broadly, the rice varieties may be classified into three main categories according to the length of the growth period. Early maturing varieties are generally grown in the upland and mountainous areas where low temperatures are possible. Medium varieties are cultivated in lowland areas with no great flooding problem, while the late varieties are grown in areas subject to water depths of as much as 2-3 metres. The growth period of these types can be more than six months since the flood period in parts of the Vietnam Delta can last from August to December. Other varieties may mature in as little as 100 days.

Local conditions, other than depth of flood and temperature may also be important. Farmers in the Ca Mau region of the Delta of Vietnam, for example, plant an early maturing variety for harvesting in late

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28. Pendleton, Robert L., "Thailand, Aspects of Landscape and Life", 1962, p.160.

November in order to save the crop from brackish water which threatens the region at the end of rainy season.[29] Here there is a possibility of a second crop too, varieties which can be harvested early are selected in order to plant the second crop in good time.

In connection with the choice of rice varieties, a mention should here be made of the basic split within the Basin between glutinous and non-glutinous rice. In general, the glutinous varieties are grown in the northern parts of the Basin, in Laos, and in the Northern and Northeast regions of Thailand. In the latter region, glutinous rice covers about 2/3 of the planted area and non-glutinous 1/3.[30] The latter type is grown mainly in the southern provinces of Nakorn Ratchasima, Surin, Buriram and Si Sa Ket, as Figure III.3 demonstrates. Although the present cultivation of glutinous rice in the basically Lao areas of the northern part of the Northeast region is a matter of taste, its original adoption was probably due to its shorter growing period suitable to more northerly areas.[31]

Within a single farm, moreover, different varieties of rice may be grown on different types of land. This may be seen as part of the overall insurance strategy practised by farm operators in many parts of

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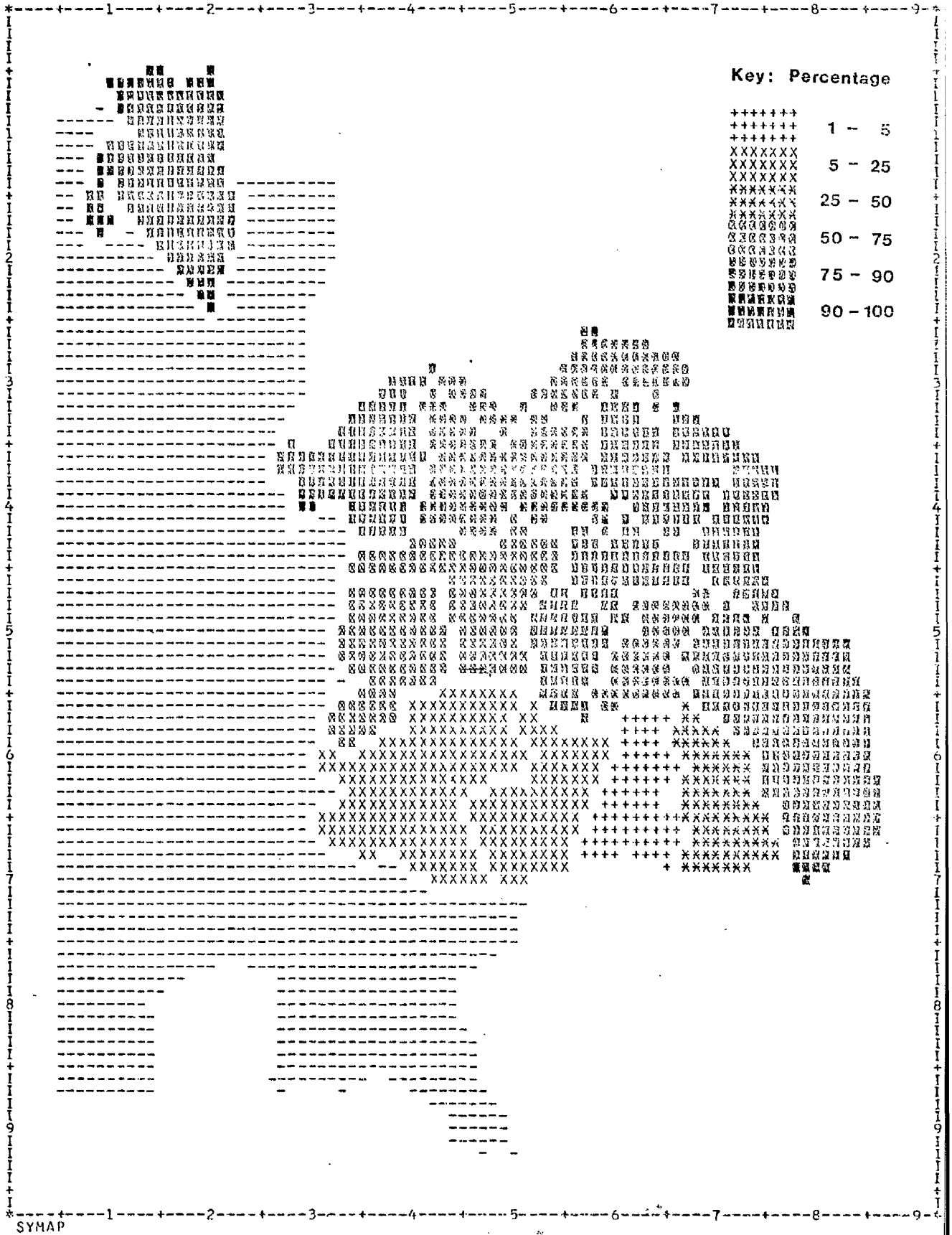
29. Naval Intelligence Division of the Admiralty, "Geographical Handbook Series, Indo-China", 1943, p.275.

30. In 1970, area of glutinous rice was 13,843,910 rai while non-glutinous rice covered 7,025,936 rai.

31. Watabe, Tadayo, "Glutinous Rice in Northern Thailand", 1967, pp. 43-47.

Figure III.3: Percentage of Glutinous Rice in Total Rice Planted Area, Northeast Thailand, 1970



Source: Annual Rice Report, Ministry of Agriculture, Thailand.

the Basin. This strategy has drawn most comment among workers in Northeast Thailand. Here most of the farmers take the precaution, where possible, of planting more land than they need for their minimum subsistence requirements to allow for a certain degree of crop loss. The land usually consists of different soil types and different elevations, so that in different climatic conditions they may insure a return sufficient to feed the household.

Reviewing this situation, Ng supports that

> "Most farmers do own two or three separate plots of land, but this is because of the need to spread risks by owning land both on the higher ground to avoid floods in the wet years and on low-lying ground to ensure some production in years of drought."

Again,

> "The ownership of land of varying soil texture facilitates the planting of different varieties of rice with different periods of growth, so that farm labour can be better utilised." 32

A particular example of this phenomenon has been noted in the Lam Pao irrigation project area in Kalasin province. Here Demaine and Dixon have pointed out that

> "In the case of Ban Non Sung, the village land consists of a series of plots situated on the low-lying land of the flood plain of the Lam Chi and slightly higher land cleared from the woodland which still surrounds the village. ..... many villagers have .... plots beside (a) lake which yield up to 80 tang per rai (5000 kgs. per hectare). Such farmers, however, also hold plots on the higher land which yield only 20-25 tangs per rai (1250-1500 Kgs. per hectare) as an insurance policy. In wet years the low lying land is flooded and farmers have to depend on their upper plot for the subsistence crop; in really

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32. Ng, op.cit., p.32.

> dry years this latter is too dry to be worked whereas the lakeside plot can be relied upon to provide for the family." 33

These writers also point out that the system of paddy-land inheritance in this area is such as to attempt to give each heir a share of the different types of land held.[34]

From these examples recorded in the Northeast region of Thailand, it seems probable that the farmers in other parts of the Basin also try their utmost in rice cultivation to compensate for the environmental conditions in similar ways. It is true, however, that this cannot always be the case. In the Delta of Vietnam, for example, farmers are unable to follow such practices. Most of the land is of a similar type and with a high population density land resources are limited. Moreover, until recently and prior to the serious fighting in the country, most farmers did not have land of their own. In 1945, 80% of the land in the Delta was cultivated by tenants, paying share-crop rates as high as 50%.[35] Only after the land reform programme of the late 1950s were holdings redistributed to small farmers.

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33. Demaine H. and Dixon C., "Land Tenure Patterns and Agricultural Development in N.E. Thailand: A Case Study of the Lam Pao Irrigation Area in Changwat Kalasin", Journal of Siam Society, vol. 60, part 2, July 1972, p.54.

34. Ibid., pp. 51-52.

35. Cao Van Than, "Agrarian Reform in Viet-Nam", The Vietnam Council on Foreign Relations, undated, p.3.

It is clear from what has been said above, however, that throughout the Lower Mekong Basin there has been a very close adaptation of agricultural practice to local environment all through the process of lowland rice cultivation. The erratic climatic conditions and the lack of any large-scale development of irrigation and flood control facilities have meant that the farmers have been forced to bear the environmental probabilities very much in mind in organising their productive forces to ensure their annual subsistence crop. Often the methods they have chosen are not the most productive over a period of years, but generally they are the safest. Indeed, despite the careful adaptation of cultural practices to the environment, rice yields recorded within the Lower Mekong Basin are low when compared with other countries outside the Basin. Figure III.4 compares the recent trends in paddy yield in a number of selected countries. As can be seen, yield per hectare in the riparian countries is generally only about one quarter to one-third of those achieved in Japan and the United States. Indeed yields are low when compared with some of the other countries in developing Asia. The average yield for Asian countries as a whole in 1970 was 2020 kg./ha.;[36] the average yield in Thailand and in the Republic of Viet-Nam was only marginally below the average, but the Khmer Republic and Laos recorded much lower levels.

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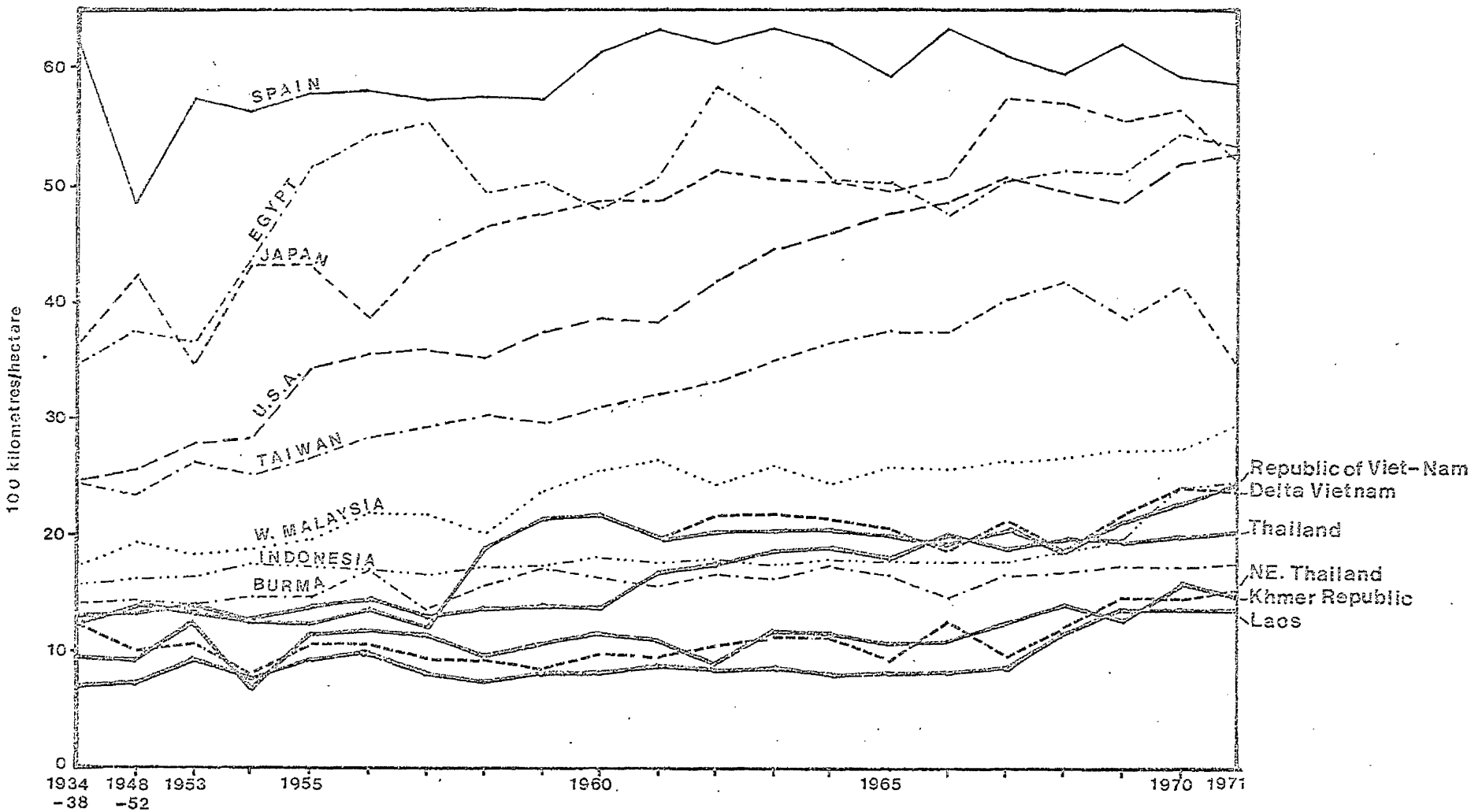
36. F.A.O., "Production Yearbook", 1971.

Figure III.4 Trends of Rice Yield in Selected Countries, 1934-71



Source: FAO Production Yearbook

These low yields result basically from the unreliability of the environmental conditions in the absence of adequate control of water supply. Evidence has been produced above that flood and drought hazards are both major factors in the lower productivity of the riparian countries and these problems are further compounded by poor soil fertility in some parts of the Basin.

The trend of rice yields in the Lower Mekong Basin has only recently shown an upward turn (Table III.4). After the Second World War, yields initially showed little improvement over pre-war figures except in Laos; indeed in Thailand's Northeast region, the cultivation of more marginal land meant that yields fell below the level of 1937-8 throughout the 1950s. Throughout the Basin the 1950s saw little improvement with yields stabilised at a low level, although individual years showed sharp fluctuations in response to environmental conditions. In Laos, the Khmer Republic and the Vietnam delta the static picture continued into the early 1960s. In Northeast Thailand, however, some improvement seems to have occurred around 1962-3 with a new upturn in returns.

However, this still left yields in this region below the pre-war level and only since 1966-67 has there been only notable improvement. The increase in the Khmer Republic from 1090 kg./ha. in 1966 to 1450 kg./ha in 1971 represents an increase of 33% over the period; at the same time, rice yields in Northeast Thailand increased 51% and Laos showed a dramatic

TABLE III.4

RICE YIELD IN THE LOWER MEKONG BASIN

1934-1971

(100 kg./ha.)

Year	Khmer Republic	Laos	NE-Thailand	Delta, Viet-Nam
			1/	
1934-38	9.8	7.0	12.4	...
1948-52	9.7	7.4	10.0	...
1953	12.6	9.3	10.6	...
1954	6.9	8.0	7.5	...
1955	11.4	10.6	9.3	...
1956	11.9	10.0	10.6	...
1957	11.2	8.2	9.5	...
1958	9.5	7.5	9.2	...
1959	10.5	8.0	8.2	...
1960	11.4	8.0	9.9	...
1961	10.9	8.7	9.4	19.7
1962	8.9	8.6	10.8	21.6
1963	11.7	8.7	11.2	21.9
1964	11.6	8.0	11.2	21.4
1965	10.7	8.1	9.2	20.8
1966	10.9	8.1	12.3	18.6
1967	12.2	8.5	9.7	21.0
1968	14.0	11.8	11.9	18.7
1969	12.9	13.5	14.8	21.7
1970	15.9	13.6	14.7	23.2
1971	14.5	12.2	14.7	23.6

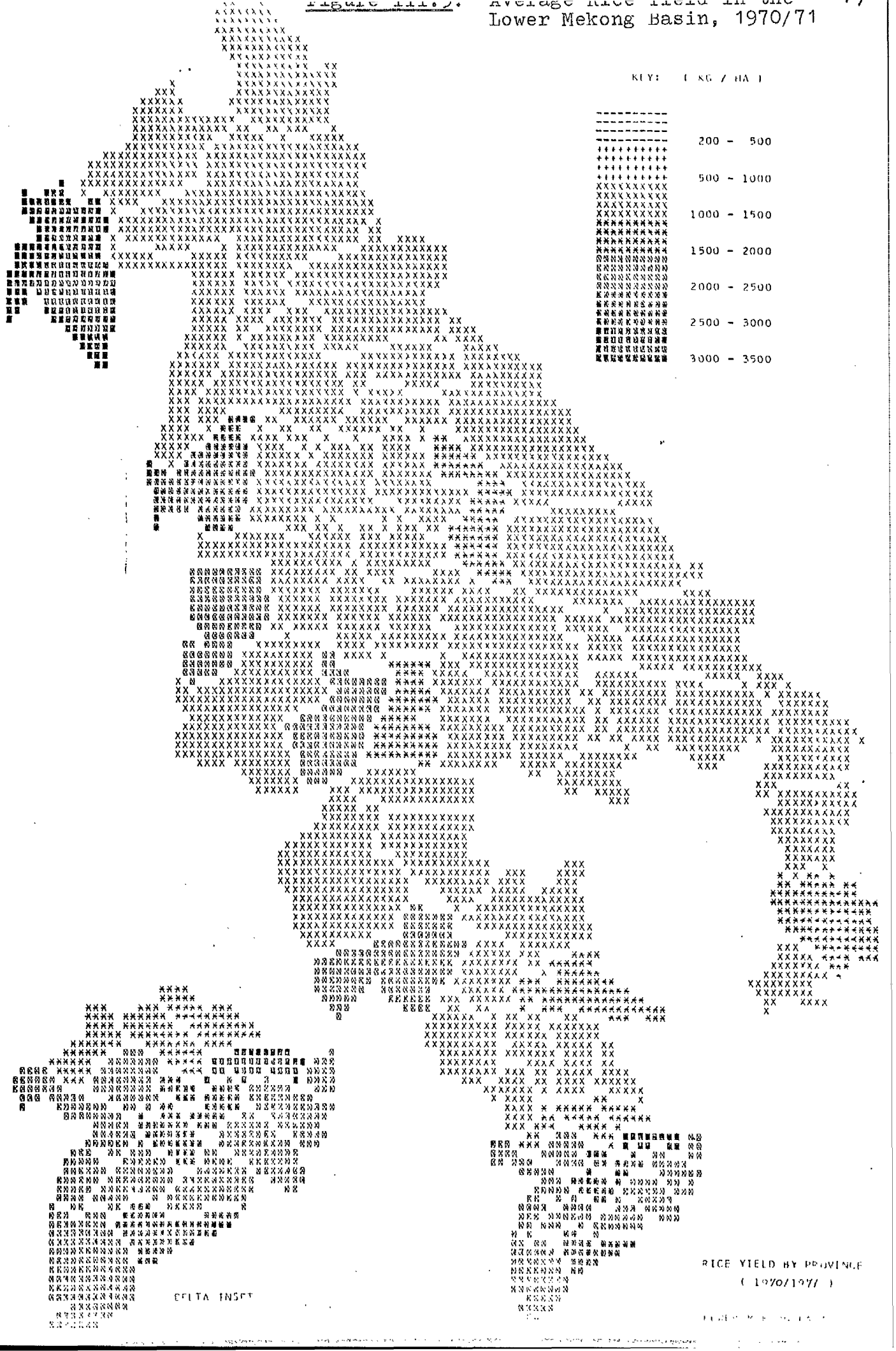
1/ Average two years , 1937-38

Source: FAO Production Yearbook, various issues.
Agricultural Statistics of Thailand, 1970
Mekong Annual Statistical Bulletin, 1972

improvement, moving up about 60% during 1967-71. In the Vietnam delta, the area of highest yield in the Basin, the increase has been shown to develop and less large, with only a 26% increase between 1968 and 1971. It may be supposed that these increases in recent years coincide with the introduction of new strains of rice into the Basin since 1966-67.

Within the confines of the Basin there are, however, wide variations in yield. The average yield was as low as 820 kgs./ha. in Laos in 1965, but more than 2000 kg./ha. in the delta area of Vietnam, with provincial extremes of 800 and 3500 kg./ha. Yields from the lowland areas in the river basins where fertility is maintained by silting each year and where irrigation and drainage facilities can be more easily developed are comparatively higher than yields in the upland areas. Cultural practices and the nature of the rice varieties grown also have a significant effect upon yield, but this also differs locally according to soil fertility. Figure III.5 shows the average yield per hectare in the Lower Mekong Basin in 1970/71 by province. Of all the regions of the Basin, Chiang Rai province in the north of Thailand has the highest yield, far ahead of the Vietnam delta; the average yield in the delta in 1970/71 was 2300 kg./ha., while Chiang Rai had an average as high as 3200 kg./ha. Explaining the high yield in the North of Thailand, Watabe states that

Figure III.9. Average Rice Yield in the Lower Mekong Basin, 1970/71



> 'There is little annual fluctuation of the average amount of rice yield per unit area; basically it is due to the fact that irrigation facilities have been comparatively well developed here.' 37

By contrast rice yields in 1970/71 averaged about 1200 kg./ha. in Laos, the same level as in the Central Highlands of Vietnam, while in the same year the Northeast of Thailand and the Khmer Republic had averages of about 1400 kg./ha. Halpern notes that

> 'The major problem of Laos with respect to na cultivation appear to be the lack of good irrigation systems, the mountainous terrain and the lack of psychological motivation.' 38

Elsewhere local variations of soil fertility reduce the regional averages. In the Khmer Republic, for example, rice fields with richer soils reach yield levels of 3000-3500 kg./ha. around Phnom Sompeau (Battambang) and Suong (Kompong Cham), but on the other hand, on the sandy soils of Kompong Speu, plots rarely attain a yield of over 800 kg./ha. 39

Similarly the average yields of the provinces of Northeast Thailand varies from 800 to 2500 kg./ha. This means a low average yield in comparison with Thailand as a whole. As Silcock notes,

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37. Watabe, op.cit., p.31.

38. Halpern, Joel M., "Economy and Society of Laos", 1964, p.40.

39. U.N., "Atlas of Physical, Economic and Social Resources of the Lower Mekong Basin", 1968, p.53.

> 'The Northeast's yields are only about two-thirds of those of the Central Plain, and here also a good deal of the planted area (7.5 percent) is damaged by poor weather conditions' 40

Variation in climatic conditions may explain in part the annual variation in yields between provinces, but this is not the whole explanation and Ubon, a province which receives plentiful rainfall has an average yield of only 800 kg./ha. Platenius notes that

> ' In order to account for the differences in yield, an attempt was made to correlate yields with total rainfall during the growing season. However, no relationship could be established; in fact, Loei and Chaiyaphum, with the highest yields, lie in the belt of lowest rainfall. It seems that fertility of the soil is the dominant factor in determining yields..... In the Northeast as a whole, newly cleared land, giving relatively high yields, is being put into production while exhausted paddy land is being abandoned at least temporarily.' 41

Yields in Northeast Thailand increased by 4.1 percent annually between 1960 and 1970, partly as a result of this process. Latterly however, the introduction of improved varieties also played a part and it is clear that the high yields on newly-opened and marginal land were only a short-term phenomenon.

In the Republic of Viet-Nam, rice yields correspond closely to the environmental conditions and the farmers' response to them. They are generally fairly high in the Delta, but very low in the Central Highlands where the rice is mostly of the upland variety, grown under shifting cultivation. Here the average yield is only just over 1000 kgs./ha. (Darlac - 1257; Kontum-1044;

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40. Silcock, T.H., "The Economic Development of Thai Agriculture" 1970, p.57.

41. Platenius, Hans, "The Northeast of Thailand, Its Problems and Potentialities", 1963, p.60.

Pleiku-1074). In the Delta the yield varies according to the flood conditions. In the area of deep flood water in the north of the Delta between the Mekong and the Bassac River, where the flood-adapted floating rice varieties are grown yields range between 1500 and 2000 kgs./ha. In the central part, where flooding is relatively less serious, but the drainage still poor, the double transplanting method is practised and yields are at their highest in the Delta with between 2500 and 3000 kgs./ha. In 1971/2 maximum yield was in Phong Dinh province with 3016 kgs./ha.[42]

Despite the presence of areas of higher yield at least comparable with the averages for other regions in Asia and a steady increase in yield levels over the past decade, rice yields in the greater part of the Lower Mekong Basin remain pitifully low. Farmers have adopted a variety of cultivation practices in response to the environmental conditions, which are undoubtedly the best available in the circumstances; they are, indeed, the result of many hundreds of years of trial and error. At the present time, however, new circumstances of rising population pressure and a desire for better living standards call for even greater increases in yields and it must be doubted if the traditional techniques are capable of providing such increases.

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42. Mekong Annual Statistical Bulletin, 1972, table 3.6, p.19.

CHAPTER IV

NEW PRESSURES ON THE TRADITIONAL ECONOMY

Although the traditional system of rice cultivation in the Lower Mekong Basin is well adapted to the existing environmental conditions, in recent years this pattern of cultivation has been coming under increasing pressure. As the population of the Lower Mekong Basin rises, so there is a need for higher levels of rice production. At the same time, the increased expectations of the vast majority of the population living in the rural areas and a growing gap in the levels of income between the rural areas and the towns necessitates the raising of the standard of living of the countryside. This is required not only in its own right, but also to help check the movement of population into towns unable adequately to absorb the influx. In order to feed the growing population at an increased standard of living, it is therefore necessary to increase agricultural productivity at a much faster rate than the rate of population growth.

Rice cultivation, as has been seen, is the basic agricultural enterprise within the Lower Mekong Basin and is at the heart of the subsistence diet. It is therefore clear that an extensive increase in the production of rice is called for to feed the population if levels of export are to be maintained. Under peaceful conditions, rice has been a major export for three of the four riparian countries and it might be expected to contribute significantly also to increased prosperity in the countryside. Events in the world rice market

in recent years suggest, however, that to achieve that prosperity a greater diversification in the agricultural economy will be needed. In this respect also, the traditional pattern of agriculture is likely to come under further pressure.

In the present chapter, the nature of some of these elements threatening the traditional economy will be examined and the scope for meeting them assessed. In the following chapter, the existing elements of diversification in the economy of the Basin will be considered in so far as they form a basis for expansion.

Trends in Population Growth within the Lower Mekong Basin

The population of those parts of the territories of the riparian countries lying within the Lower Mekong Basin was estimated to have reached some 31.9 million by 1972. (Table II.1) As compared with a total of 18.5 millions in 1954, this represents an increase of 72% over the intervening period.[1] In the last ten years, the growth rate has averaged about 2.8% per annum, a rather lower rate than in the preceding period but still at a high level.

Rapid natural growth of population has significant implications for a country not only in terms of overall size of population, but also of its age structure and the rate of growth of the labour force. In the Lower Mekong Basin, the rates of population increase are high, even by general Asian standards as

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1. Calculated from Mekong Annual Statistical Bulletin 1972, table 1.1 and 1.2, pp. 1-2.

Table IV.1 shows. The growth rate of population in the Northeast region of Thailand was as much as 2.8% per year during the period 1947-1960 and since then, a rate of 2.95% has been recorded between 1960 and 1970.[2] For the Khmer Republic, Laos and the Republic of Viet-Nam the average annual growth rates during 1963-1968 were estimated at 2.2%, 2.4% and 2.6% respectively.[3]

The present relatively high rate of population growth has been brought about by the institution of an effective health programme which has produced a notable fall in the mortality rate. This has been particularly marked in the case of infant mortality with the result that there are now a large number of children within the population in relation to those of working age. As shown in Table IV.2, the proportion of the population under 15 years of age in the four riparian countries is more than 40%, while the effective working population constitutes only 50% of the total.

Population density and distribution.

The population of the Lower Mekong Basin is spread very unevenly within the Basin. There are few dense concentrations of population, except in and around the major cities like Phnom Penh, Vientiane, Nakorn Ratchasima and Ban Me Thout. The highest rural

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2. Thailand, "Statistical Yearbook, 1970-71", No.29, 1972, table 12, pp. 37-39 and table 15, pp. 42-43.

3. UN/ECAFE/Mekong Committee, "Annual Statistical Bulletin", 1972, table 1.3, p.3.

TABLE IV.1

AVERAGE ANNUAL GROWTH RATE OF POPULATION IN SELECTED COUNTRIES

(1950-1970)

Country	Total population (000)			Annual Growth Rate	
	1950	1960	1970	1950-60	1960-70
Khmer Republic	4,074	5,440	6,938	2.9	2.5
Laos	1,805	2,337	2,962	2.6	2.4
Thailand	19,635	26,392	35,814	3.0	3.1
Republic of Viet-Nam	12,366 a/	14,100	18,332	3.4	2.7
Burma	18,489	20,662	27,584	1.1	2.9
Philippines	19,868	27,792	38,493	3.4	3.3
Japan	82,900	93,200	103,540	1.2	1.1
Taiwan	7,476	10,612	14,035	3.5	2.8
Malaysia	5,227	6,909	9,135	2.8	2.8
Mexico	25,706	34,988	50,670	3.1	3.8
Spain	28,086	30,128	33,290	0.7	1.0
U.S.A.	151,689	180,670	205,395	1.8	1.3
		(millions)			
Asia	1,386	1,679	2,056	1.9	2.1
Southeast Asia	175	214	287	2.0	3.0
World Total	2,510	2,995	3,632	1.8	2.0

a/ 1956

Source: Demographic Yearbook, United Nations.

TABLE IV.2

PERCENTAGE DISTRIBUTION OF POPULATION BY AGE GROUP

Age Group	Khmer Republic (1962)	Laos (1971)	Thailand (1964-67)	Viet-Nam, Rep. (1962)
0 - 4	14.9	16.7	17.4	18.7
5 - 9	15.6	13.4	14.7	14.3
10 - 14	13.3	11.6	13.2	10.2
0 - 14	43.8	41.7	45.3	43.2
15 - 19	9.3	10.1	10.1	9.0
20 - 24	8.2	8.9	7.6	7.0
25 - 29	7.3	7.8	7.1	7.0
30 - 34	6.7	6.7	6.2	6.2
35 - 39	5.6	5.6	5.4	5.8
40 - 44	4.5	4.9	4.2	5.0
45 - 49	3.9	4.0	3.5	4.6
50 - 54	3.3	3.3	3.1	3.8
55 - 59	2.5	2.6	2.5	3.1
15 - 59	51.3	53.9	49.7	51.5
60 - 64	2.0	1.9	1.9	1.8
65 - 69	1.3	1.3	}	1.4
70 and over	1.5	1.2	3.1	2.1
Unknown	0.1	-	}	-
60 and over	4.9	4.4	5.0	5.3
Total	100.0	100.0	100.0	100.0

Source: Annual Statistical Bulletin, Mekong Committee, 1972.

densities are found in the valley of the Mekong River and its major tributaries. Figure IV.1 shows the overall pattern of population density throughout the Basin by administrative unit. Although the great capital cities of Saigon and Bangkok lie outside the Basin, the average population density is higher than the average national density in each of the four countries.

Laos is very sparsely populated. According to the latest official estimates, for 1962, Laos has an average population density of only 12 persons per square kilometre. There is a notable variation in density between the hilly northern provinces and the southern provinces bordering the Mekong River. The heavier concentrations are found only in the lowlands, but even here the average density is fewer than 40 persons per sq. km., while the hill areas may shelter as few as 1 person per sq. km.[4] With a relatively low population density even in the most densely settled areas, Laos is unlikely to face much problem of population pressure.

In the Khorat Plateau of Northeast Thailand, the population has crowded into the broad valleys of the Mun and Chi Rivers, where few crops other than rice are grown. At present, the highest densities are to be found in the provinces of Mahasarakham, Roi Et, Surin, Si Sa Ket and Ubon Ratchathani. By the census of 1970,

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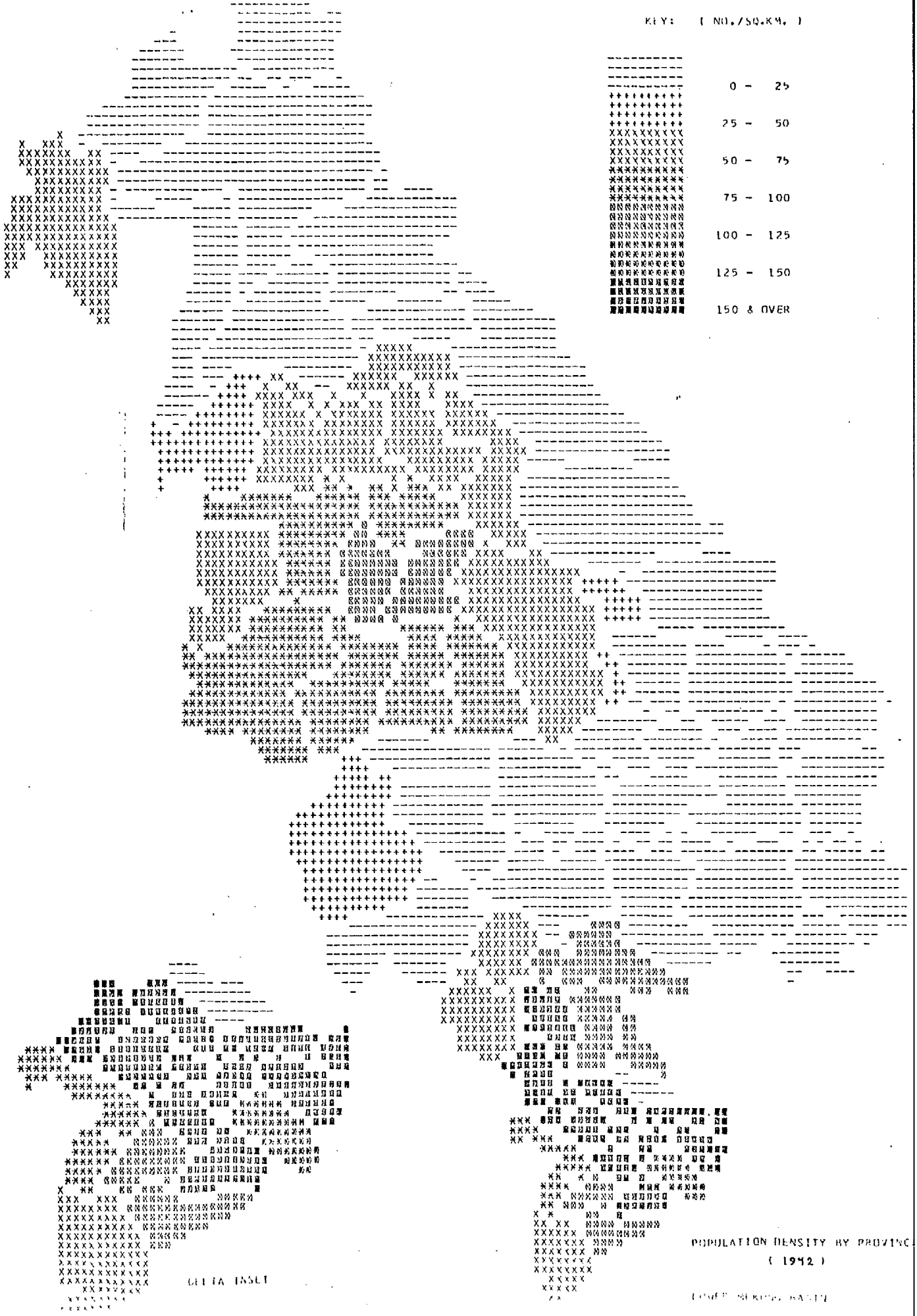
4. Hawkins, Richard S.D., "Contours, Cultures and Conflict", in Nina S. Adams and Alfred W. McCoy (eds.), "Laos: War and Revolution", 1970, p.5.

Figure IV.1: Population Density Distribution in the Lower Mekong Basin, 1972



the overall population density in the Northeast was 70 persons per sq. km. compared with the density for the whole country of about 66 persons per sq. km.[5]

Although these density figures suggest that the Northeast is relatively under-populated, they are scarcely a true indication of local population pressure. Although land resources are adequate for the existing population in the region as a whole, in the central and southern parts of the Northeast the natural fertility of the soil has declined and cultivation has been extended to marginal land. In some areas the expansion of planted area seems to have reached the saturation point and the land will no longer support the population under the traditional system of agriculture. Platenius has observed moreover that there is in the region an inverse correlation between population density and yield: that is to say, the provinces with the higher population densities tend to have the lower average yields.[6] Areas of virgin land are still to be found in the northern part of the region, especially in Nongkhai, Udon Thani, Sakon Nakhon, Nakhon Phanom and Loei, but, although in part the problem may be solved by encouraging migration to these areas, the land must be used intensively at the same time under a new system of farm management.

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5. Thailand, National Statistical Office, "Preliminary Report of the 1970 Population and Housing Census of Thailand", 1970.

6. Platenius, Hans, "The Northeast of Thailand, Its Problems and Potentialities", 1963, pp. 18-19.

According to the 1962 census, the average population density in the Khmer Republic was 32 persons per sq. km.[7] Once again the aggregate figure masks wide variations. The vast majority of the population lives along the flood plains of the Mekong downstream of Kratie and of the Tonle Sap and Bassac rivers. Delvert states that 90% of the population live in one-third of the total area in the plain along the main rivers and canals.[8] Population is extremely high in the capital city district of Phnom Penh and extremely low in the most peripheral areas; Kandal has nearly 400 persons per sq.km., while in Mondulkiri the density is only 1 person per sq. km.

In 1972, the total population of the Republic of Viet-Nam was estimated at 19 million persons. The distribution is most uneven with congested coastal deltas contrasting sharply with the sparsely settled highlands. The density in the Delta of the Mekong was about 183 persons per square kilometre in 1972, although the population in the more coastal parts was much lower than in the area between the Mekong and Bassac Rivers inland. Even these areas of lower density were, however, more heavily populated than the highlands of the Annamite Chain, where the density in 1972 was only 18 person per square kilometre.[9]

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7. Mekong Annual Statistical Bulletin, 1972, table 1.4,p.4.
8. Delvert, Jean, "Le Paysan Cambodgien", 1961, p.21.
9. Mekong Annual Statistical Bulletin, 1972, table 1.4, p. 9.

More than three-quarters of the population lives in villages and hamlets, but the Republic of Viet-Nam has a number of large urban centres, some of which are very sizable. The biggest of these, however, like Saigon itself, Da Nang, Hue, Gia Dinh, Qui Nhon and Nha Trang, lie beyond the bounds of the Basin.

Migration Patterns

A brief examination of the distribution of population in the Lower Mekong Basin has shown wide areas of extremely low population density contrasting with a number of regions in which the pressure of population on the land has reached quite serious proportions. It is from these areas that recent population movements have taken place in an effort to adjust the population to the available land resources. With increasing population and the continual fragmentation of existing holdings, young men are leaving such areas to find other opportunities elsewhere. Recent improvements in transportation have tended to make such movements easier.

Migration in the Basin is mainly of two types, rural-urban and rural-rural. Whatever its nature, as Ng notes,

> 'It is beyond dispute that such migration is the direct response to certain known opportunities...' [10]

For a large number of people these opportunities lie in the towns. Though the population of the Lower Mekong

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10. Ng, Ronald C.Y., "Recent Internal Population Movement in Thailand", Annals of the Association of American Geographers", Vol. 59, No.4, 1969, p.717.

Basin is still predominantly rural, there is an increasing rate of urbanization, especially to the capital cities, Bangkok, Saigon-Cholon and Phnom Penh. Urbanization outside these cities is not very rapid, although particularly in Laos, the Khmer Republic and Vietnam the growth of the city population has been accelerated by the insecurity of the countryside. Moreover, as Chapman and Allen state

> "There is a suggestion, then, that the Northeast in particular has recently experienced a substitution of Bangkok for intra-regional destinations which previously absorbed so much of the out-migrant flow....It seems from the 1955-60 data that there is a trend in the recent period for some longer-distance intraregional migration to be re-oriented towards Bangkok, and consequently for Bangkok to gain a bigger share of the in-migrants arriving in the Central region." 11

On the other hand, as Keyes points out,

> "Lack of non-farm skills, difficulties in adapting to agricultural patterns in other regions, problems of adjusting to new social patterns ... and the costs of transport (especially if a whole family is migrating) are factors which conversely discourage migration outside the Isan region." 12

and throughout the Basin inter-rural migration remains of considerable significance.

In the Northeast of Thailand, the percentage of migrants in the total population has been slightly higher than in the rest of the country; the 1960 census noted that migrants in the Northeast numbered 10.8% of the total, compared with 9.8% for the country as a whole.[13]

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11. Chapman, E.C. and Allen, A.C.B., "Internal Migration in Thailand", 1965, p.11.

12. Keyes, Charles F., "Isan in a Thai State", 1965, p.88.

13. Platenius, op.cit., p.22.

Of these, only 20% moved outside the region, constituting only 2.0% of the regional population in 1960, although there is also a considerable amount of seasonal migration from the area each year which has a very important role in the economy of the Northeast villages. There are clear patterns in the dominant intraregional component and, as Ng notes,

> "In choosing a destination, the migrant generally prefers an area with which he is more familiar, where he can practice his traditional skill, where he will be living among people with a similar cultural background and above all an area where necessary changes and adaptations are at a minimum." 14

The degree of movement is higher in the depressed parts of the region which contributed 55% of the total number of migrants from the Northeast, while internally 13% of the people who were born in the overpopulated area of the Mun and Chi valleys have migrated to more promising areas elsewhere.[15] Udorn Thani province has been the outstanding regional focus for migration, a province where kenaf and tobacco planting expanded greatly at the end of the 1950s.[16]

The movement of population in and out of the Northeast region of Thailand has also been influenced by the unsettled political situation in Laos and in each of the other countries in the Lower Mekong Basin this factor is dominant in the recent migration patterns, although here little detailed work has been carried

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14. Ng, op.cit., p.718.

15. Platenius, op.cit., p.22.

16. Chapman and Allen, op.cit., p.13.

out on specific migration patterns in the absence of reliable data. In the case of the hill tribes, the political situation has, however, quickened existing movements from the hill-tribe areas. This movement has varied locally according to the size and location of the individual village, the land available for the traditional slash-and-burn cultivation and the quality of the soil. The movement has been more frequent from the more mountainous areas with steeper slopes where soil erosion is much greater than at a lower altitude. In general the movement is almost always southward and takes place in family groups after an advanced party has scouted the new location. A particularly important recent movement has been that of the Meos moving from Xieng Khouang province to Luang Prabang, Sayaboury and Vientiane; here warfare has added impetus to a movement begun as a result of soil exhaustion and overpopulation. Similar trends are at work in the highland areas of both the Khmer Republic and Vietnam.

Population movements have been a long term phenomenon in Vietnam, where population from the densely-peopled north have long been moving into the Mekong Delta region. During the French colonial period the construction of canals for drainage and the extension of the network of waterways in the delta really stimulated migration and the Delta has been converted into an area of high population density. Further southward movement followed the partition of Vietnam in 1954, with over 900,000 north Vietnamese

entering the south as refugees.[17] Under a government programme of 1956 these and other farmers from the overcrowded Delta areas have been encouraged to take up land near the Cambodian border. More recently, however, the dominant trend has been escape from the warfare. The lack of security has obliged many farmers, especially from the Central Highland provinces of Pleiku, Darlac and Kontum, to abandon their land and take to the towns. A similar situation now applies to the Khmer Republic. Here other population movements since independence have been largely as result of the government resettlement policies. A statement by Prince Sihanouk in 1956 sums up the rationale of these movements:

> "We later want to settle people in the frontier zone in order to prevent the Vietnamese from penetrating into our country." [18]

Thus large numbers of hill tribe peoples and Khmers were settled in the frontier areas, with thousands of Khmer Loeu moving to Sok Chlong and other areas in Kratie, Stung Treng and Rattanakiri provinces.[19] As population has increased other areas have been chosen as resettlement zones with the large fertile area of Battambang province becoming the focus for personnel discharged from the armed forces, Khmu refugees from South Vietnam, unemployed townspeople and young people unable to find occupation in trade and industry.[20]

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17. Smith, Harvey H. et al., "Area Handbook for South Vietnam", 1967, p.63.

18. Steinberg, David J., "Cambodia, its people, its society, its culture", 1959, p.30.

19. Munson, Frederick P. et al., "Area Handbook for Cambodia", 1968, p.56.

20. Ibid., p.37.

It has been through migration that increases of population have traditionally been compensated for within the countries of the Lower Mekong Basin. Ng has stated, speaking of the Northeast of Thailand, that

> "Each stage of population increase seems to have been accommodated by bringing more land into cultivation with the same traditional method of farming instead of striving to intensify the system." 21

In the past, the increase of population was not as high as at the present day and there was plenty of arable land in the Basin available for cultivation. Thus the increased population could be supported by continued forest clearance. These methods have continued up to the present and in parts of the Basin, the expansion of the planted area in the 1960s has been at least as fast as in the 1950s.

However, the present rate of population growth means that it is becoming increasingly difficult to obtain an adequate quantity of food production from cultivation under the same traditional system. Most of the suitable rice areas in the Basin have now been occupied and the scope for expanding the cultivated area is limited. The high population density in the Delta of Vietnam and the outmigration from the fertile Mun and Chi valleys of Northeast Thailand suggest that the best rice-growing areas are fully occupied. Small amounts of cultivable land are available; in Northeast Thailand this is to be found mainly in the northern

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21. Ng, Ronald C.Y., "Some Land-Use Problems of North-east Thailand", Modern Asian Studies, 4, 1, 1970, p.27.

provinces of Udorn, Loei, Nongkhai and Sakon Nakhon; elsewhere the available land resources are in the mountainous areas of Laos, the Central Highlands of the Republic of Viet-Nam and the dry western provinces of the Khmer Republic. Generally, however, the limit of cultivation has been pushed onto the marginal land and these areas are variously infertile, mountainous or too dry for paddy cultivation.

With the reduction of the area available for the expansion of cultivation, some other means are required to meet the needs of the increased population. It is true that family planning policies may help eventually to reduce the rate of population increase, but at present the government programmes are having little success, particularly in the rural areas. Population growth is bound to continue beyond the capacity of the mere extension of cropped area to feed it. Production can be raised somewhat by increasing the intensity of cultivation on the existing area to give higher yields, but there is a limit to the increases which can be achieved through increased inputs of labour - the only means of intensification available under the traditional technology.

To increase the yield per unit area therefore, the acceptance of new cultural practices would appear to be necessary. Indeed some writers have suggested that this is a normal way out of such difficulties. Boserup, for example, has stated that

> "The new approach to agricultural development which is signalled by the concept of frequency of cropping draw the attention to the effect upon agricultural technology which are likely to result from population changes." 22

The new methods of increasing productivity are currently available to the farmers of the Lower Mekong Basin through the use of new seed varieties, fertilizers and pesticides, irrigation and mechanization. Within the Basin, the traditional seed varieties of the subsistence rice crop, all of the Indica group, are only marginally responsive to fertilizer; the development of new fertilizer-responsive seeds will enable the benefits of fertilization to be felt in the form of higher yields. The overall effect of these innovations depends very much, however, on the better control of the environmental conditions, particularly of the supply of water. The problem of the uncertainty of water supply which causes the great variations in the level of production can be reduced by the establishment of flood-control systems and irrigation projects. Moreover, as Ng notes

> "Modern irrigation projects of large scale can supply the vital needs in the dry season so that the cropping period can be extended." 23

Rising Expectations

Through the intensification of production by the adoption of modern cultivation practices, it is probable that the countries of the Lower Mekong Basin

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22. Boserup, Ester, "The Conditions of Agricultural Growth", 1965, p.14.

23. Ng, 1970, op.cit., p.37.

will continue to be able to feed their growing populations. However, the mere provision of subsistence needs cannot be the final aim of those seeking to develop the agricultural economy of the Basin. Increases in the yield of paddy may provide the population with sufficient food, but this is unlikely to provide a complete answer to increasing the standard of living of the people, nor is it likely to reduce the large income disparity between the urban and rural areas. There is a great difference between the incomes of the farm and non-farm family in the Basin. Anderson, talking of Thailand and referring to 1963, notes that

> '..the average monthly income of rural families was 480 baht (US$ 24) or less than one half of the income in towns (1048 baht) and less than one-third of Bangkok incomes (1519 baht).' 24

This gap is widening, moreover, as a result of the lower rate of growth of the agricultural sector when compared with industry, commerce and services.

Today, however, the obvious gap between urban and rural standards of living is acting as something of an incentive to the rural population. Improvements in transport networks and the spread of consumer goods into the smaller towns in the regions has brought a new awareness to the countryside. According to Siloock,

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24. Anderson, Dole A., "Marketing and Development, The Thailand Experience", 1970, p.43.

> 'One of the most striking changes in the last decade has been the great increase in the number of farmers who are aware of change and of increased individual income as possibilities. New roads and country buses, expanded centres of administration in every province and the widespread diffusion of battery-operated transistor radios have all contributed to this change.' 25

Thus it is that there has been increased migration in search of jobs to provide a cash income, usually on a seasonal basis, with the rural youth leading the way. At the same time farmers are looking out for opportunities for obtaining a more regular income from the farm than the occasional sale of surplus rice and handicrafts allowed. The farmer of the Lower Mekong Basin is becoming more properly 'economic man', for as Motooka suggests

> 'A thirst for cash income accompanying the change in the pattern of consumption, a recognition of the necessity for an increase in income in order to meet this, and a positive desire to improve the management of the holding in order to produce this increase in income - these are the necessary conditions for their qualifying as homines economici.' 26

To provide for these desires for a higher standard of living rice production in the Lower Mekong Basin must not merely keep pace with the population increase, but rather remain above the domestic consumption requirements.

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25. Silcock, T.H., "The Rice Premium and Agricultural Deversification" in T.H. Silcock (ed.), "Thailand, Social and Economic Studies in Development", 1967, p. 246.

26. Motooka, Takeshi, "The Conditions Governing Agricultural Development in Southeast Asia", The Developing Economies, Vol. V, No. 3, 1967, p.427.

In the traditional economy, the farmers grew rice primarily to supply their own domestic needs. Part of any excess production was stored for future emergencies, part for the seed requirements for the next season. The remainder could then be sold for local consumption and, after this market was satisfied, for export. With unreliable environmental conditions, sales could be highly irregular for a great many farmers in the region with a surplus only marginal to domestic needs. Overall, however, sufficient surplus was obtained each year to make the Lower Mekong Basin a substantial rice exporter.

Population growth can be expected to cut into this surplus in the future unless productivity can be increased. Indeed a regular surplus will be required to satisfy the need for a cash income among the farm families of the area, a cash income which has become a necessity for most families. It is probable that with improved cultivation techniques this surplus rice situation can be maintained for some years to come. A question must be asked, however, of whether it is wise to maintain such an emphasis on the traditional paddy crop. Recent trends in the world rice market have suggested that rice cannot be looked upon as the assured export earner for the countries of the Lower Mekong Basin that it has always been assumed to be - even given the region's capacity to provide an export surplus.

The World Rice Market

Rice has long been the most important export of the Lower Mekong Basin. Before the Second World War, Thailand and Indochina followed Burma as the second and third largest rice exporters in the world, together contributing about 34% of the total export supplies. During the period 1934-38, indeed, the total export from the four riparian countries averaged some 2.7 million tons of milled rice per year.

In this period most of the rice from Indochina was imported by the colonial power, France and by her other colonies in Africa and elsewhere. In the immediate pre-war period, from 1935 to 1939, France and French Colonies imported on average about 733 thousand tonnes per year out of the mean export of 1.553 million tonnes recorded by the countries of Indochina.[27] The exports from Thailand came mainly from the Central Plain, outside the confines of the Lower Mekong Basin, although the southern provinces of the Northeast region did make a significant contribution to exports of non-glutinous rice, while the region alao supplied glutinous rice to Laos. The destination of Thailand's exports was more varied than those of Indochina, with Japan, Malaya, Hong Kong, Singapore and Indonesia being her chief customers.

During the war, rice production from non-Asian sources had increased and afterwards exports increased from the United States, Mexico, Egypt and to a lesser extent Italy. This made up for disruption of supplies

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27. U.S. Department of Agriculture, "The Agriculture of French Indochina", 1950, table 6, p.23.

in the traditional Asian producing countries, but could not fulfil the whole demand and rice prices remained at high levels in the early 1950s. Under the stimulus of high prices, however, the production of the Lower Mekong Basin countries increased and by 1954, their percentage of world exports had risen beyond the pre-war level. In that year, Thailand was responsible for 19% of exports and the Indochina countries for a further 16%.[28]

After the recovery of the position of the Mekong Basin countries in the 1950s, the rice export market remained fairly stable for some time. In an increased volume of exports, the region's share fell slowly, reaching 23.9% in 1958. Export volume from the area fluctuated according to annual weather conditions. In 1961-2 for example, exports from the Republic of Viet-Nam were badly reduced as a result of abnormal flooding and the government decision to stockpile rice to ensure the internal food supply. Exports remained generally steady, however, and in 1964, Thailand became the world's largest exporter as supplies from Burma were reduced. Table IV.3 shows recent trends in exports in the riparian countries.

The poor harvests throughout Asia in 1965 and 1966 changed the situation. The traditional exporting countries could not increase supplies to the required extent; by this time the effects of warfare had indeed turned the Republic of Viet-Nam into a net importer.

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28. Grist, D.H., "Rice", 1959, p.367.

TABLE IV.3

RICE EXPORT OF THE RIPARIAN COUNTRIES

1960-1972

(thousand metric tons)

Year	Khmer Republic	Thailand	Republic of Viet-Nam
1960	319.8	1,202.8	340.0
1961	239.1	1,576.0	154.5
1962	131.2	1,271.0	83.9
1963	377.9	1,417.7	322.6
1964	491.4	1,896.3	48.7
1965	472.9	1,895.2	129.6*
1966	165.6	1,507.6	434.2*
1967	200.3	1,482.3	750.3*
1968	193.9	1,068.2	677.9*
1969	102.8	1,023.1	341.0*
1970	200.0	1,063.6	567.7*
1971	35.0	1,576.1	137.2*
1972	...	2,075.9	271.0*

* Imports

Source: Monthly Bulletin, Bank of Thailand, 1973
Viet-Nam Statistical Yearbook, National Institute of Statistics.
Annual Statistical Bulletin, Mekong Committee, 1972
FAO Trade Yearbook, 1972

The shortage was met from other sources, notably the United States and Japan, but the entry of these two producers onto the world market on a large scale has since posed problems for the rice exporting countries of the Lower Mekong Basin.

The non-Asian producers and Japan have begun to pose intense competition to Thailand and the Khmer Republic. Exports from the United States increased from less than 1 million tons on average for the period 1959-1963 to 1.9 million tons in 1969. Moreover some of the American trade has been carried out under concessionary agreements or direct aid agreements such as Public Law 480, which has meant that supplies from there have been cheaper than Southeast Asian rice. Such policies have equally been followed by Japan. Japan, indeed, used to be a major rice-importer, but reduced its imports from an average of over 1 million tons in 1952-56 to only 196,000 tons over the period 1959-63.[29] Latterly she has ceased to import and since 1968 has accumulated a large rice surplus.

Japan's movement from a major importer to a large-scale exporter of rice highlights the new difficulties for the rice exporting countries of the Lower Mekong Basin. Japan's example has more over been followed since 1967 by a number of traditional importing countries in the region, who with the introduction of high-yielding varieties and other aspects

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29. Ceres, F.A.O. Review, "Behind the Rice Market Changes", Vol. 4, No. 2, 1974, p.15.

of the Green Revolution are striving to achieve self-sufficiency in paddy production. The Philippines ceased importing from the Lower Mekong Basin in 1968 and Pakistan, Ceylon, Indonesia and Malaysia have all reduced their imports. In 1972 indeed, Malaysia recorded a marginal surplus.

Thus the rice exporters of the Lower Mekong Basin are being squeezed on two sides. The policies for the achievement of self-sufficiency followed by erstwhile importers and the rise of major new exporters like the United States and Japan has hit the markets of Thailand and the Khmer Republic. Thailand's share of the world market dropped from 20% during the period 1959-63 to only 15% in 1969 and the volume of rice exported fell from 1.30 million tons to 1.06 million tons.[30] In order to increase exports Thailand was forced to reduce and then remove her rice export tax, but the rice could only be sold at a lower price. The total value of Thai exports of rice fell from 4334 million bahts in 1965 to 2909 million bahts in 1971. In the Khmer Republic too, the value fell sharply from 1935 million riels in 1965 to 479 million riels in 1969.[31] Since that time the Khmer Republic like the Republic of Viet-Nam has been heavily hit by the devastations of the Indochina War.

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30. Ibid., p.17.

31. Statistics from Mekong Annual Statistical Bulletin, 1972.

Since 1971, the incidence of crop failure in several countries in the region and the reduction in the planted area in the United States and Japan has assisted Thailand at least to recover her former position, particularly with the cessation of Khmer exports. Nevertheless the general situation looks unfavourable for the restitution of exports from the riparian countries on an assured basis. Most of the countries of South and Southeast Asia now appear to have the capacity to achieve self-sufficiency in the near future, or indeed at present, given peace and favourable weather conditions. Certainly the struggle for export markets seems likely to become more intense with lower prices to the producers a distinct possibility.

Rice has been a cash crop as much as a subsistence crop for many farmers of the riparian countries for many years, giving an assured price and return whenever the farmer had surplus to sell. The changing world market conditions, with a yet smaller proportion of production likely to enter the international market suggest that to rely on rice production as a source of cash income in the future may be unwise for many farmers. The high yield potential of the river valley areas and of the Mekong Delta may favour rice cultivation, but elsewhere in the Basin the crop has been extended onto marginal land where other enterprises may be preferable. With the traditional premium on producing their own subsistence crop and the high price of rice in the

market compared to production costs, it is unlikely that farmers will feel able immediately to abandon rice cultivation. Effort must be made, therefore, to increase the rice production off a smaller planted area and thus release some land for other more lucrative enterprises. The intensification of production requires greater investment and improved water control; diversification requires the careful examination of the returns from other possible enterprises. These questions will be considered in the Chapters which follow.

CHAPTER V

ELEMENTS OF DIVERSIFICATION IN THE ECONOMY OF THE LOWER MEKONG BASIN

Although the traditional agricultural system of the Lower Mekong Basin, based on the subsistence cultivation of lowland rice, may be capable of feeding the growing population and of providing a continued, albeit declining, surplus, international competition and the instability of demand for rice on the world market is likely to make it an increasingly unreliable source of income for the rural population. It would seem to be an unfavourable base from which to increase the standard of living of the farmers. To escape from the widespread dependence on a single crop, the achievement of self-sufficiency in rice should be accompanied by an increased diversification into other crops and farming enterprises - dry season cropping on the paddy land, non-rice farming on the uplands, fisheries development and animal husbandry according to the individual farm conditions. If the farmers can concentrate their rice cultivation on a smaller proportion of their farms and achieve a higher yield per unit area, even in the wet season, the remainder of the farm can be cultivated for other cash crops that will bring a higher income to the farmers.[1]

Certainly, the prosperity of the majority of the population within the Basin would seem to lie in the development of agricultural resources. As will be shown

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1. Ng, Ronald C.Y., "Social and Economic Determinants in rice cultivation in Northeast Thailand", Seminar on contemporary Thailand, 1971, p.15.

below, the non-agricultural sector of the economies of the riparian countries remains relatively underdeveloped and most of the industrial employment opportunities are concentrated in the capital cities.

Although the traditional economy of the Lower Mekong Basin has generally been described as a rice monoculture, some elements of diversification did exist within it. When the farmer is free from rice cultivation, other secondary enterprises are also practised. During the dry season, farmers have been accustomed to spend their time on traditional craft industries, in the rearing of livestock and in fishing. In the colonial period in Indochina moreover, a number of plantation crops were introduced, notably rubber and coffee and these have provided employment to the rural population on either a part-time or full-time basis. More recently, there has been the expansion of cash crop production, notably in the Northeast region of Thailand where kenaf, maize and cassava have all expanded substantially in acreage since the 1950s.

In the present chapter, it is proposed to examine each of these elements of diversification to assess their potential in assisting the economic development of the Lower Mekong Basin and in helping to increase the standard of living of the people.

Secondary enterprises in the rice economy

(a) Livestock

Livestock farming has not generally been practised as a primary economic enterprise in the rural areas of the Lower Mekong Basin. Although water buffalo and

cattle are kept in large numbers by the farm families, they are chiefly kept for work purposes, such as ploughing, harrowing and threshing within rice cultivation and for transportation. Few of the buffalo at least are raised specifically for their meat, but most farmers tend to see both buffalo and cattle, which are sold on retirement, as a form of investment. In recent years some cattle have been raised for sale. In addition to cattle and buffalo, pigs and poultry are raised almost everywhere in the Basin mainly for domestic consumption.

Although livestock rearing may not be a primary economic enterprise, it does still make a significant contribution to the Gross National Product of the riparian countries. In the Khmer Republic, for example, livestock contributed more than 8% of the primary industries sector over the period 1959-63[2] and in the Northeast of Thailand it constitutes the second most important item in the agricultural sector.[3] In terms of exports too, livestock makes an important contribution. Northeast Thailand has long been a major buffalo and cattle raising area and large numbers of animals were driven on the hoof to the Central Plain in the past.[4]

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2. Statistics from Statistical Unit, Mekong Committee, Bangkok.

3. N.E.D.B., "Gross Domestic Product - Northeast Thailand 1960-69", 1971, table 2, pp. 4-5.

4. Pendleton, Robert L., "Thailand, Aspects of Landscape and Life", 1962, p.209.

Today substantial numbers are still exported, but now by train or truck. Livestock exports have recently increased in importance in the economies of both Laos and the Khmer Republic. Apart from the export of live animals, chiefly to Vietnam, hides and skins are also a notable export commodity. Exports of the latter from Laos increased from 154 tonnes in 1961 to 303 tonnes in 1971, ranking third in terms of exports by value at that date.[5] Although Vietnam must import buffalo and cattle, farmers in the Delta have undertaken commercial duck-rearing for export, when conditions allow, mainly to Singapore.[6]

Problems of livestock rearing

Despite the useful contribution to GDP and to regional and national exports made by livestock, the secondary nature of this activity is testified by the lack of real care taken in the rearing of the animals. Buffaloes and cattle are left to forage in the forest fringes or along water courses to find their feed, except after the harvest when they may be permitted to graze the stubble and weeds or natural grasses in the fields. Rice straw is an important fodder but this too is of generally low nutritional value. Pigs too are raised under poor conditions; although they are sometimes fed with rice bran mixed with the pulp of the

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5. UN/ECAFE/Mekong Committee, "Annual Statistical Bulletin", 1968 and 1972, table 10.3.

6. U.S. Department of Agriculture, "The Agriculture of French Indochina", 1950, p.46.

banana tree, they are normally left to find food in the field or housecompound. Due to inadequate nourishment, many pigs are long and thin. Poor feeding also affects the quality of poultry, which can be undersize and have a very low egg yield. Ducks particularly can be highly susceptible to disease as a result; in Laos, cholera is a major problem nearly every rainy season and discourages their production.[7]

There is little improved pasture in the Lower Mekong Basin. In Northeast Thailand, with the largest concentration of livestock rearing in the Basin, the only improved pastures are to be found at Pakchong in Nakorn Ratchasima province.[8] In the Northeast 60% of the land area is forest and grazing land, so that the area of pasture is adequate, but this is nevertheless unable to provide the necessary animal protein requirement during the dry season.[9] The indigenous grasses are tough and poor in nourishment at this time and some more vigorous variety is required to improve the dry season feed. Ideally, to provide additional feed for the livestock at this time, any development of livestock should be co-ordinated with the encouragement of fodder crops like sorghum and maize.

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7. Kaufman, Howard K., "Village Life in Vientiane Province (1956-57), Laos Project # 12, undated, p.8.

8. Louis Berger Inc. (Development Economic Group), "Northeast Thailand, Economic Development Study", Final Report, Vol. II, Appendix, 1972, p.V-86.

9. Ibid., p. V-88.

Not only has there been little improvement in pasturage, but there has been little regard to the health and improvement of livestock in the countries of the Lower Mekong Basin. Foot and mouth disease is a considerable problem amongst cattle[10] and the susceptibility of poultry has already been mentioned. Indiscriminate breeding is another factor which causes decadence in the stock. Only recently have foreign stock been introduced and most of the livestock raised are still local breeds of inferior quality. Often the best animals are the ones which are sold for slaughter, leaving the poorer for breeding purposes.[11] In any case, the lack of grading or quality control and the marginal difference in price between good and bad quality animals gives the farmer little incentive to raise the quality of his stock.

Such problems of disease and poor quality make the marketing of the livestock products of the riparian countries abroad a very difficult matter. Export markets demand meat of higher standard than that acceptable locally. Even Thailand, where the standards are probably higher than in the other countries, has been experiencing problems in selling to Japan, a major importer of its beef, because of the latter's strict import rules to prevent the entry of foot and mouth disease.[12] Clearly many improvements are necessary

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10. Ibid., p. V-90.

11. Naval Intelligence Division of the Admiralty, "Geographical Handbook Series, Indo-China", 1943, p.287.

12. Louis Berger Inc. (Development Economic Group), op.cit., p. V-109.

before livestock can take a more important place in the export economy of the Lower Mekong Basin and provide a greater source of income for the rural population.

(b) Fisheries

Another important supplement to the agricultural economy of the Lower Mekong Basin is fishing. Fish and fish products are characteristically the most important addition to the rice diet in the area. In 1960, the fishing industry contributed some 8.8% of the GNP in the Khmer Republic and 3.0% in the Republic of Viet-Nam.[13] These figures include both marine and inland fisheries, but in Northeast Thailand fisheries were responsible for 3.7% of the agricultural sector and 1.7% of the total GDP in 1969.[14]

Besides the offshore resources, the Lower Mekong Basin contains a vast wealth of inland fishing grounds of greater or lesser extent. The Tonle Sap is the largest and most important of these. It contains a great variety and quantity of fish and the catch constitutes about half of the total annual production of the Khmer Republic.[15] In Northeast Thailand, the Nong Han swamp in Sakon Nakorn province which drains into the River Mekong is a particularly important centre and the numerous canals and distributaries criss-crossing the delta of Vietnam are also ideal for fishing.

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13. UN/ECAFE/Mekong Committee, "Report on Indicative Basin Plan", 1970, p.III-34.

14. N.E.D.B., op.cit., p.13.

15. Steinberg, David J., "Cambodia, its people, its society, its culture", 1959, p.26.

Throughout the Basin, the Mekong itself and its tributary streams add to the wealth of fishery resources.

The major rivers and lakes are, however, only a part of the available resources. Shallow lakes on the Khorat plateau, mountain streams in Laos and the Republic of Viet-Nam and equally significantly the flooded paddy fields of the Basin all provide opportunities for farm families not living close to the major sources. More recently, the construction of irrigation tanks, particularly in Northeast Thailand, and of larger reservoirs for irrigation has begun to benefit those families in their neighbourhood, while the associated irrigation canals are yet another new source.

In the permanent water sources of the Basin, fishing is carried on throughout the year, but the enterprise as a whole is most productive during and immediately after the rainy season. Fishing in the Great Lake starts when the Lake begins to drain into the Mekong River towards the end of the rainy season, while fishing in the paddy fields exactly coincides with the rainy season, beginning in May and ending in December when the paddy fields, swamps and other natural water resources are beginning to dry up.[16] Such is the extent of these inland fishery resources that the actual catch is very difficult to estimate and the figures quoted for total catch and contribution to GDP are probably gross underestimates. For Laos, data on the total catch are completely absent; for Thailand and the Khmer Republic the mass of the catch is from marine

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16. UN/ECAFE/Mekong Committee, "Socio-Economic Aspects of Fishery Operation in the Nam Pong Reservoir, 1970-71", 1972, p.5.

sources. In the Republic of Viet-Nam, the total fish catch from fresh water is said to have increased from 55,000 tons out of a total of 255,000 tons in 1962 to 71,100 tons out of 506,600 tons in 1971.[17]

Most of the fresh water catch enumerated is secured by commercial operators, but most of the farmers of the Basin do take part in fishing on a part-time basis and mainly for their own family consumption. Thus most of the techniques used do not require much cash outlay and they are mainly of home construction. The actual apparatus depends on the nature of the water and the kind of fish sought, but a variety of nets, traps and baskets, lines and spears are all used. Even when boats are used, they are usually home-constructions, propelled by paddles rather than by motor.

Although fishing is a widespread activity among the farmers of the Lower Mekong Basin, for most it remains a subsistence and a leisure pursuit and the possibilities for further commercial development of the inland fishery resources does seem to be limited. Already there are signs that the practice of fishing in the future will have to be more carefully regulated, especially in the main inland fishing grounds. The Great Lake particularly has been showing a steady decline in the total (commercial) catch. Before the Second World War, the catch averaged some 100,000 tons annually.[18] By 1957 the total had fallen to about

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17. UN/ECAFE/Mekong Committee, "Annual Statistical Bulletin", various years, table 6.1.

18. U.S. Department of Agriculture, op.cit., p.48.

50,000 tons and in 1967 it was only 35,000 tons. The supply of fresh-water fish is being rapidly depleted, apparently for two main reasons. According to the Mekong Committee,

> "Sedimentation has reportedly increased at a rapid rate, making the lake shallower and shallower. Substantial portions of the inundated forest have been destroyed or heavily exploited for fire-wood, detracting from its value as a fish nursing area. Accompanying these events, there has been heavy fishing". 19

Other factors are equally having an effect on the level of catch. Where controls have not been imposed on fishing, the intensity has sometimes increased to an extent that yields have begun to decline. In addition a special problem has arisen with the construction of storage reservoirs for hydro-electricity and irrigation. Although these may constitute important fishing grounds in their own right, they have had the effect of disrupting the cycles of fish reproduction, growth and harvest by blockage of upstream spawning grounds. In the Northeast of Thailand, for example, the total fish catch increased on average at 11.6% annually between 1960 and 1965, but from 1965-69, the average annual growth rate was only 5.2%.[20] This decline has been partly attributed to the construction of storage reservoirs in Kalasin and Nakorn Ratchasima provinces which caused changed patterns of water distribution.

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19. UN/ECAFE/Mekong Committee, 1970, op.cit., p.III-39.

20. N.E.D.B., op.cit., p.13.

Even those farmers able to take part in fishing on a commercial scale face difficulties in expanding. To supply more than just local markets requires much improved transport facilities in the rural areas than at present. Most small-scale inland fishermen have to sell to middlemen at the present time and these traders dispose of the produce in the main markets either fresh or quite frequently as dried or processed fish, which generally command a lower price. In such circumstances the scope for most farmer-fishermen to supplement their income from fishing is strictly limited.

Additions to the traditional economy

Although the agricultural economy of the Lower Mekong Basin continues to be dominated by rice cultivation and the secondary activities associated with it, in the last century, a number of elements of diversification have appeared. In the countries of Indochina, the French colonists were responsible for the introduction of cash crops, notably rubber, pepper and maize. Each of these continues to hold an important place in the economies of the independent countries, particularly in Vietnam and the Khmer Republic, and rubber has been especially significant in circumstances of declining rice revenues. In the Northeast region of Thailand, non-rice cash crops have been a more recent introduction, but over the last two decades, kenaf, maize and cassava have all contributed to the total agricultural earnings of the region to a notable extent.

(a) Rubber

The establishment of rubber plantations was one of the first elements of diversification in the economy of the Lower Mekong Basin and rubber still constitutes one of the region's major export commodities. For the Khmer Republic, rubber exports have been the second most important means of earning foreign exchange after rice and since the 1960s rubber has been Vietnam's main export. In 1969 rubber contributed 40% of exports by value in the Khmer Republic and 79% in the Republic of Viet-Nam.[21] In Thailand, as in Cambodia, the value of rubber exported has traditionally been second to rice, but here the main rubber growing areas are in the southern peninsular and in the southeast, outside the Lower Mekong Basin area. In Laos, a few rubber plantations were developed, but these are not on the same scale as in the other Indochinese countries.

Favourable soil and climatic conditions in Indochina have encouraged the development of rubber cultivation. Rubber plantations have been introduced on well-drained soils both at low elevations and in the plateau areas. Figure V.1 shows the general location of rubber plantation areas in both the Khmer Republic and the Republic of Viet-Nam. As can be seen, in the Khmer Republic the rubber plantations are located primarily in the south of the country, east of the Mekong River. The principal concentration is in the province of Kompong Cham which produces almost 90%

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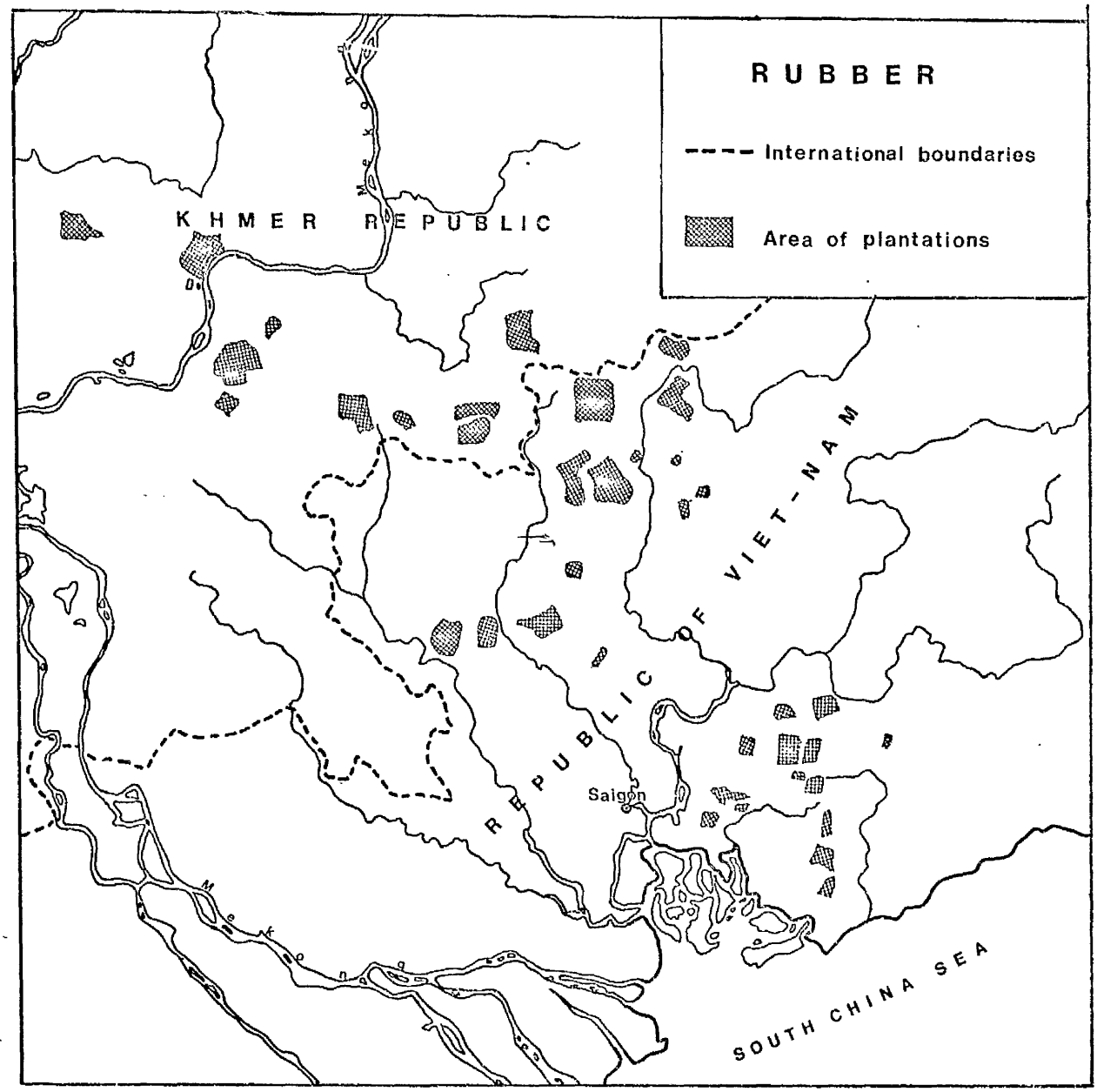
21. Calculated from Mekong Annual Statistical Bulletin, 1972, table 10.1 and 10.3, pp. 30, 32.

Figure V.1: Location of Rubber Plantation Areas in the Khmer Republic and the Republic of Viet-Nam



Source: Agricultural Statistics Yearbook, Republic of Viet-Nam

of the total Khmer production on well-drained fertile reddish-brown upland soils of volcanic origin.[22] The rubber-planting area in the Republic of Viet-Nam is largely around Saigon, although rubber is also grown in the Central Highlands of the country.

Rubber was first introduced into Indochina from Malaya in 1897, but there was little expansion of production until after the First World War.[23] Then the French established plantations in the Kompong Cham area to the south and east of Kratie and the steady growth of area planted to rubber and of rubber production began. The rubber plantations, owned by a number of French companies, required the intensive use of labour and this was generally provided in Cambodia by the import of plantation workers from Vietnam in some thousands.

Expansion continued until the Second World War and Indochina as a whole became the world's fifth largest rubber exporter. The U.S.A. was the chief customer, taking 40% of imports in 1936, the total of 16,800 tons being slightly higher than the 12,100 tons exported to France. Damage to the plantations and to the transport system during the Second World War caused a rapid decline in production immediately afterwards and some estates, notably on the Bolovens plateau in

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22. Steinberg, op.cit., p.198.

23. Smith, Harvey H. et al., "Area Handbook for South Vietnam", 1967, p.329.

Laos, had to be abandoned. However, French interests established new estates in the post-war period and production rapidly picked up. Even in 1946, before the new estates became operational, exports had reached 137,000 tons, with France replacing the United States as the main customer with 55% of the total to the latter's 45%.[24]

Nevertheless, the rubber industry of Cambodia and Vietnam has faced continued problems since that time. Rubber exports have shown a steady decline since the partition of Indochina, although the value has varied from year to year according to world prices. Although the French have tried to develop and improve techniques of planting and tapping in order to increase production, much of the stock of the estates is old and yields have been very low. The need for replanting has been clear, but the general security situation has worked against its implementation. Rubber cultivation in the Khmer Republic and in the Republic of Viet-Nam is still overwhelmingly carried out in the large estates, mostly owned by large French groups like the SOCFIN corporation. These corporations have the capital to invest in new high-yielding stock, which smallholders tend to lack, especially in view of the 6-8 year maturation period before the young trees begin to yield their latex. As the Indochina war has become more intense however, investment has been more difficult. Vietminh invasions of Laos in the early part of the conflict and subsequent

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24. U.S. Department of Agriculture, op.cit., pp. 29-30.

disease have reduced the acreage in that country.[25] In Vietnam estates have had to stockpile rubber since they have been unable to get it to the market; in 1965 two of the country's largest plantations were closed down for lack of security; new planting has fallen off steadily since 1964.[26] Production has fallen dramatically. From a peak of 78,140 tons in 1961, it decreased to just 33,000 tons in 1970.[27] The spread of the war into the Khmer Republic since 1969 has also badly affected the rubber industry there. Most of the plantations were closed in May 1970 and limited production was only restored in July of the following year.[28] In addition, the security problem has meant that the Cambodian estates have had difficulty in recruiting labour for tapping from the traditional sources in Vietnam.

The security problem in Vietnam and Cambodia is clearly having an important affect on the rubber industry of the two countries. Even if steady production were possible, the disruptive effect of the warfare would be felt for some time to come in terms of the need to rehabilitate the estates. The world consumption of rubber has risen rapidly since World War II, but much of this expansion has been taken up by the increase in synthetic rubber production. Indeed natural rubber

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25. LeBar, Frank M. and Suddard, Adrienne, (eds.) "Laos, its people, its society, its culture", 1963, p.204.

26. Smith, op.cit., p.329.

27. Republic of Viet-Nam, "Viet-Nam Statistical Yearbook", various years.

28. Fareastern Economic Review, "Rubber, Cambodia on the Rebound", December 25, 1971, p.40.

alone has been incapable of satisfying the demand and its share of the world market has gradually declined. Continual technological advance in synthetic rubber production has made it more competitive. Delafield supports that,

> "The manmade material is produced under particularly strict production conditions and quality control by highly complex, modern equipment giving a high degree of sophistication in the final product that has assured synthetic rubber of an ever-increasing role in a widening range of applications". 29

For natural rubber, quality control is highly complex. To compete with the synthetic product, the production cost of natural rubber must be decreased and greater standardization of production. New high yield strains will be able to make the natural product more competitive and either increase, or at least maintain its share of the world market.

Unfortunately, even with efficient production, the place of natural rubber in the world market in recent years has still been insecure. World prices have tended to relate to the amount of synthetic rubber put on the world market by the United States and natural rubber producers earnings have been affected accordingly. Prices were low in 1968 for example, but improved the following year when the U.S.A. stopped sales from their stockpile.[30]

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29. Delafield, P.A., "Wider Scope for Synthetic", The Times, March 19, 1969, p.11.

30. The Commonwealth Secretariat, London, "Plantation Crops", 1970, p.211.

Although recent events in the world oil market seem likely to improve the competitive position of natural rubber, the industry in the Lower Mekong Basin does not appear to be in a position to benefit fully from this. The security situation has prevented the large estates from carrying out their programme of replanting to the extent necessary; some stock has been destroyed by bombing or defoliant chemicals; the estates have generally run down. As a plantation crop, the rubber industry does not widely affect the traditional farming economy in any case, but the heavy investment required will certainly preclude any further expansion of rubber cultivation on smallholdings in the region. Rubber cannot be seen as a major element of diversification for the traditional economy in the near future.

(b) Maize: A Major Non-Plantation Crop

Next to rice, maize is the second most important crop of the Lower Mekong Basin in terms of area planted. It has long been important in parts of the Basin as a supplementary food crop, and, among some of the hill peoples of Laos it can be the major cereal crop. This was particularly true among the Meos in the mountainous areas of Sam Neua and Xieng Khouang provinces.[31] More recently however maize has become a major cash crop for the farmers of the Basin, particularly in the Khmer Republic and in Thailand, although in Thailand most of

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31. Robinson, H., "Monsoon Asia", 1966, p.303.

the production is now outside the limits of the Basin itself. The cash cropping tradition has been of longer standing in the Khmer Republic, dating back before the Second World War. Over the period 1936-38, 85% of the total maize production of Indochina was exported with Cambodia contributing over 50% of total production.[32] In the 1960s maize has commonly been the third largest source of export income, after rice and rubber, but in terms of volume it has come second. In Thailand, maize has been an important export commodity since 1958. Since then it has slowly grown in importance and has been threatening to overtake rice and rubber as the major export earners.[33]

The expansion of maize cultivation in Indochina dates once more from the French colonial period. Prior to this the area planted was small and the crop was mainly grown for human consumption in the highlands of Laos and central Viethan, where it is still to be found. The French encouraged the cultivation of maize to provide animal feed for export, mainly to France, from the 1920s and the planted area increased rapidly in the 1930s chiefly in Cambodia. Here the planted area increased from 50,000 hectares in 1929 to 300,000 hectares in 1936.[34]

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32. U.S. Department of Agriculture, op.cit., p.27
33. In 1971 maize exports totalled 2,286 million bahts, compared to rice earnings of 2,909 million bahts and returns from rubber of 1,905 million bahts. (Bank of Thailand, Monthly Bulletin, December 1973, vol. XIII, no. 12, table III.7, pp. 50-51).
34. Naval Intelligence Division of the Admiralty, op.cit., p.279.

The Second World War brought a disastrous decline in the area planted, falling to only 5,500 hectares in 1946.[35] Here after there was a steady increase until the early 1950s, since when planted area has been generally stable around 100,000 hectares. This is notably below pre-war levels, attaining varied between 120,000 and 210,000 tonnes, with a maximum in 1964. In the early 1960s, over 70% of the production was commonly exported, but in more recent years, production has not achieved the former levels and exports have also declined.[36] (Table V.1)

In Thailand the expansion of maize cultivation has been a post-World War II phenomenon, following government attempts to encourage crop diversification in the 1950s. The area planted has increased rapidly from 36,160 hectares in 1950 to 829,280 hectares in 1970.[37] The Northeast region has taken part in this expansion; here the cultivated area went up from 13,120 ha. in the year 1950 to 80,960 ha. in 1960, although since that time the expansion here has slowed down with notable annual fluctuations in acreage. The planted area in 1970 was 134,130 hectares.[38]

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35. Ministere du Plan, Annuaire Statistique Retrospectif du Cambodge (1958-60), Royaume du Cambodge, Tables 4-5, p.41.

36. This is partly a response to government policy of substituting livestock exports for maize. See below Chapter VI.

37. Thailand, Ministry of Agriculture, "Agricultural Statistics of Thailand", 1970, Table 15, p.50.

38. Thailand, Ministry of Agriculture, "Agricultural Development Plan, Northeast Region, 1972-76", 1971, p.14.

TABLE V.1

PRODUCTION AND EXPORT OF MAIZE, KHMER REPUBLIC

1959-1971

(metric tons)

Year	Production	Export	Percent of export
1959	122,000	106,800	87.5
1960	118,000	163,900	138.9
1961	147,000	103,630	70.5
1962	175,000	134,440	76,8
1963	200,000	114,930	57.5
1964	210,000	148,500	70.7
1965	139,000	81,560	58.7
1966	149,500	133,420	89.2
1967	154,000	64,850	42.1
1968	117,600	87,630	74.5
1969	137,000	55,340	40.4
1970	121,100	38,692	31.9
1971	122,000	8,093	6.6

Source: Annual Statistical Bulletin, Mekong Committee.

FAO Production Yearbook.

FAO Trade Yearbook.

In Thailand indeed, the focus of maize production has shifted westward out of the Northeast region into the Central Plain. In 1951, five out of the ten leading maize producing provinces were in the Northeast, but by 1965 only Nakhon Ratchasima figured in the leading provinces.[39] This change in the pattern of corn cultivation is based on the comparative soil characteristics of the two areas. The early expansion of maize in the Northeast took place generally on poor upland soils of low fertility. Although some of the area planted was cultivated on the shifting cultivation system, steady cropping has reduced soil fertility except in favoured areas. Faced with competition from the better endowed areas of the Central Plain where the soil has a higher limestone content that is relatively better suited for maize, the planted area of the Northeast has stabilised and is generally concentrated in that part of the region with similar soil conditions notably in the Pak Chong district of Nakhon Ratchasima (see Figure V.2). Although high-yield varieties were first introduced in the Northeast, production did not concentrate in this area for other reasons too. Silcock states that the shift was partly due to better land, but also to better water transport associated with the Chainat dam in the Central Plain and to the migration of population from the congested

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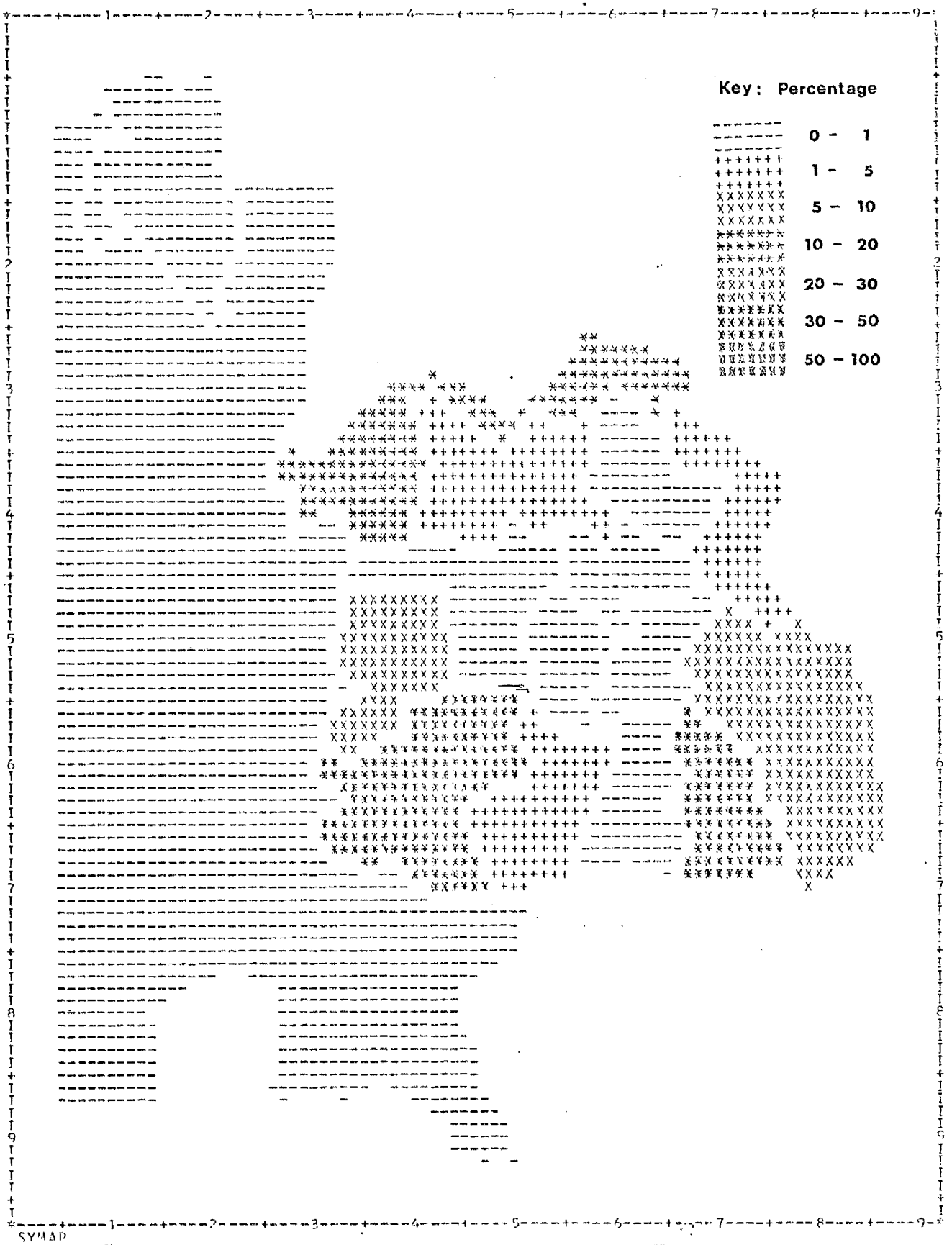
39. Silcock, T.H., "The Economic Development of Thai Agriculture", 1970, p.85.

Figure V.2: Percentage of Maize in Upland Planted Area, Northeast Thailand, 1970



Source: Agricultural Development Plan, Northeast Region, 1972-76, Ministry of Agriculture, Thailand, 1971

areas of the Northeast to the northern Central Plain area.[40] In addition, the increasing price of kenaf in the world market, at the end of the 1950s and especially in 1961, also encouraged much of the upland cultivation in the Northeast to change from maize to kenaf.[41]

In Thailand, maize is being cultivated mainly on those upland soils which are generally too dry for paddy cultivation. This pattern is repeated in Indo-china; in the Khmer Republic, Kompong Cham is the main producing province along with Kandal and Takeo.[42] Most of the maize is grown in the wet season, being sown in the first rains of the year and harvested some three-and-a-half months later. Delayed rains can cause a drought problem for the crop. In selected areas in the Basin, maize can be grown as a dry season crop, being planted in August or September and harvested in the early winter. This is usually the case along the river terraces and levees of the Mekong and its distributaries in the Republic of Viet-Nam and the Khmer Republic, where the land is well drained and cannot be used for second crop rice. In Thailand too, some dry season cultivation is to be found, this having been made easier by the widespread use of Guatemala seed varieties introduced in the 1950s.[43] This not only has a superior

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40. Ibid., p.88.
41. Behrman, J.R., "Supply Response in Underdeveloped Agriculture - A case study of four major annual crops in Thailand, 1937-63", 1968, p.136.
42. Munson, Frederick P. et al., "Area Handbook for Cambodia", 1968, p.228.
43. Behrman, op.cit., p.43.

grain quality and gives higher yields but is also adaptable to a wide range of environmental conditions.

Despite the continued importance of maize in the agricultural economy of the Lower Mekong Basin, it is clear that the current situation is a little uncertain. In Thailand, it is apparent that the northern part of the Central Plain possesses advantages in the cultivation of maize over the greater part of the Khorat region; it seems unlikely that this area will show a marked expansion of maize cultivation in the future. In Indochina, the security situation is as much a problem with maize as with other crops. Since 1956 indeed, the Republic of Viet-Nam has normally had to import maize, frequently via United States' aid.[44]

An equally important problem in the region is that of quality control. This is generally poor throughout the region compared with that of the United States and South America. Although the Guatemalan varieties are widespread in Thailand, in the Khmer Republic there has been little improvement of quality and of yield since World War II. The red maize still common in the Khmer Republic gives lower yields than other types and export problems led the Cambodian government to develop a programme in 1958 to substitute cattle for maize as an export by fattening at home.[45]

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44. The import of maize was as high as 25,733 metric tons in 1963 for use in the government pig-corn programme to stimulate swine production based on maize feed. Figure from Viet-Nam Statistical Yearbook.

45. Munson et al., op.cit., p.238.

In addition, there is the problem throughout the Basin of the high moisture content of the wet season maize, which tends to limit export to more distant markets.[46] Careless sorting, causing mixing of varieties, poor packaging and shipment before the grain is completely dry are other factors that damage the quality of the crop and therefore export prospects.

Such difficulties of quality control pose problems for both the major exporters of the Lower Mekong Basin in diversifying their export markets. Cambodian maize was sent mainly to France pre-World War II and the French domination of the trade did continue after independence. The Thai maize market too has been dominated by a single customer, Japan. Sato has argued that the main impetus to the development of maize production in Thailand came when the Japanese required feed for their growing livestock industry.[47] During the years 1958-60, Japan bought about 80% of the total Thai exports and increases in export have depended mainly on the fluctuation of demand from Japan until 1967. Since then the external market has been effectively widened to include Taiwan, but in 1970 these two countries between them purchased more than 75% of the export total (Figure V.3). This is rather dangerous for Thai export prospects. There is great competition in the world corn market, especially from the United States, Argentina and South Africa, and Japan has been seeking to diversify

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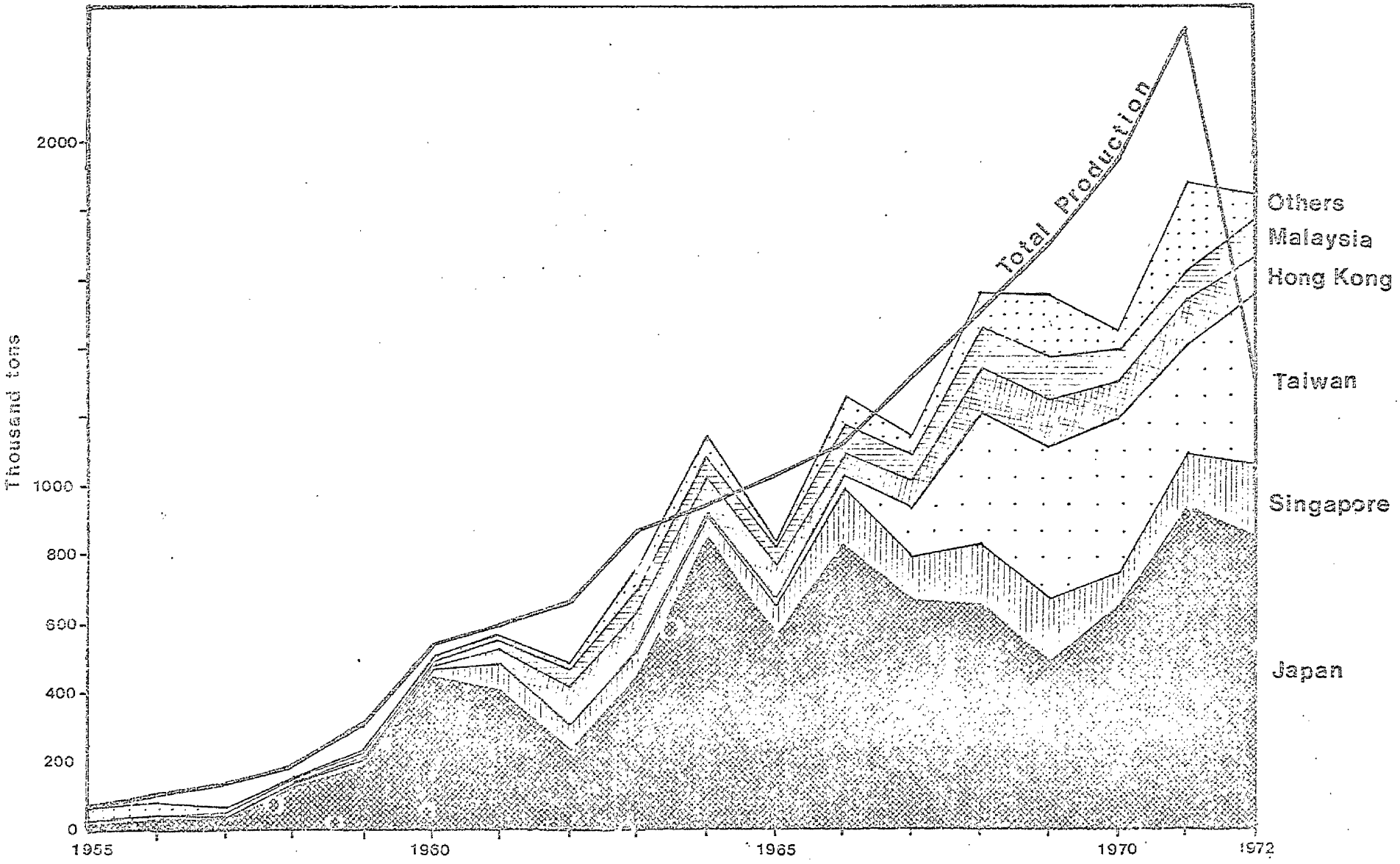
46. Silcock, op.cit., p.91.

47. Sato, Takashi, "Field Crops in Thailand", Reports on Research in Southeast Asia, Natural Sciences-N-1, 1966, p.9.

Figure V.3 Exports of Maize from Thailand, 1955-1972



Source: Monthly Bulletin, Bank of Thailand

her sources of supply by aiding the feed grain industries of both Indonesia and the Khmer Republic.[48] It seems likely that the producers of the Lower Mekong Basin could be in direct competition with each other if the security situation allows.

(c) Kenaf: a new enterprise in Northeast Thailand

Kenaf is the most important of the new crops recently introduced into the agricultural economy of the Lower Mekong Basin, but its expansion has been largely confined to the Khorat Plateau of Thailand. It is now Thailand's most important fibre crop and in the Northeast region it covers an area second only to rice. Northeast production forms over 95% of the output for the whole country in a normal year and it makes a significant, if fluctuating contribution to the region's Gross Regional Product. Table V.2 shows the actual and proportional contributions of kenaf from 1960 to 1969.

Although kenaf was being grown in Petchabun province in the 1940s, the expansion of the crop only dates from 1959-60. Silcock states that

> "the motives for promoting kenaf growing in Thailand were the desire for industrialization and the quest for crops suitable for the climate and soil of the Northeast; kenaf was also assisted by an opportune failure of the jute crop in Pakistan at a time when the Thai industry was ready to respond to high prices." 49

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48. Thailand, NEED, Subcommittee on Agriculture and Water Resources, "NEEDPAG Status Report on Agricultural Strategy and Programme, the role of marketing", 1970, p.13.

49. Silcock, op.cit., p.77.

TABLE V.2

PROPORTIONAL CONTRIBUTIONS OF KENAF TO GDP. FROM CROPS

NORTHEAST THAILAND, 1960-69

(in million bahts)

Year	Total agriculture section	Total from crops	Kenaf a/	Percent to total crops
1960	5,803.7	4,339.9	362.3	8.4
1961	5,937.5	4,408.1	452.3	10.3
1962	6,437.0	4,770.3	266.3	5.6
1963	7,207.5	5,437.4	405.5	7.5
1964	6,841.8	5,060.3	578.7	11.4
1965	7,068.7	5,206.5	992.0	19.1
1966	8,672.6	6,690.0	1,232.7	18.4
1967	6,918.2	4,884.9	937.7	19.2
1968	7,549.6	5,378.4	363.1	6.8
1969	8,469.9	6,224.9	710.0	11.4
Average annual growth rate	4.2	4.0	7.8	-

a/ Include Jute and Ramie.

Source: Gross Domestic Product - Northeast Thailand 1960-69, NEDB, 1971

Given this opportunity and finding the suitable conditions in the Northeast, Thai kenaf production expanded rapidly after 1959-60 into almost every province of the region. Kenaf grows well in the relatively infertile sandy soils which dominate the upland areas of the region. These are found throughout and the planted area increased from a mere 50,000 ha. in 1950 to 400,000 ha. in 1970. This was in fact lower than the peak year of 520,000 ha. in 1966.[50] Figure V.4 shows the trends in area planted during this expansion. Although all provinces grow some kenaf, the main areas of cultivation in 1970 were Khonkaen, Mahasarakham and Chaiyaphum provinces.[51]

Like maize, the expansion of kenaf has taken place on upland which is basically unsuitable for paddy, so that it represents a further expansion of the cultivated area. Despite the fact that the kenaf will grow successfully on the sandy soils, there are fears that continued cropping may be removing the nutrients from the soil and that fertility is declining. Although at first the crop was grown under shifting cultivation, today most cultivation is on a permanent basis and loss of soil fertility and soil erosion may become a problem. Already evidence of soil exhaustion is reported and in several provinces farmers have had to move into new areas to find new land which is increasingly marginal.[52]

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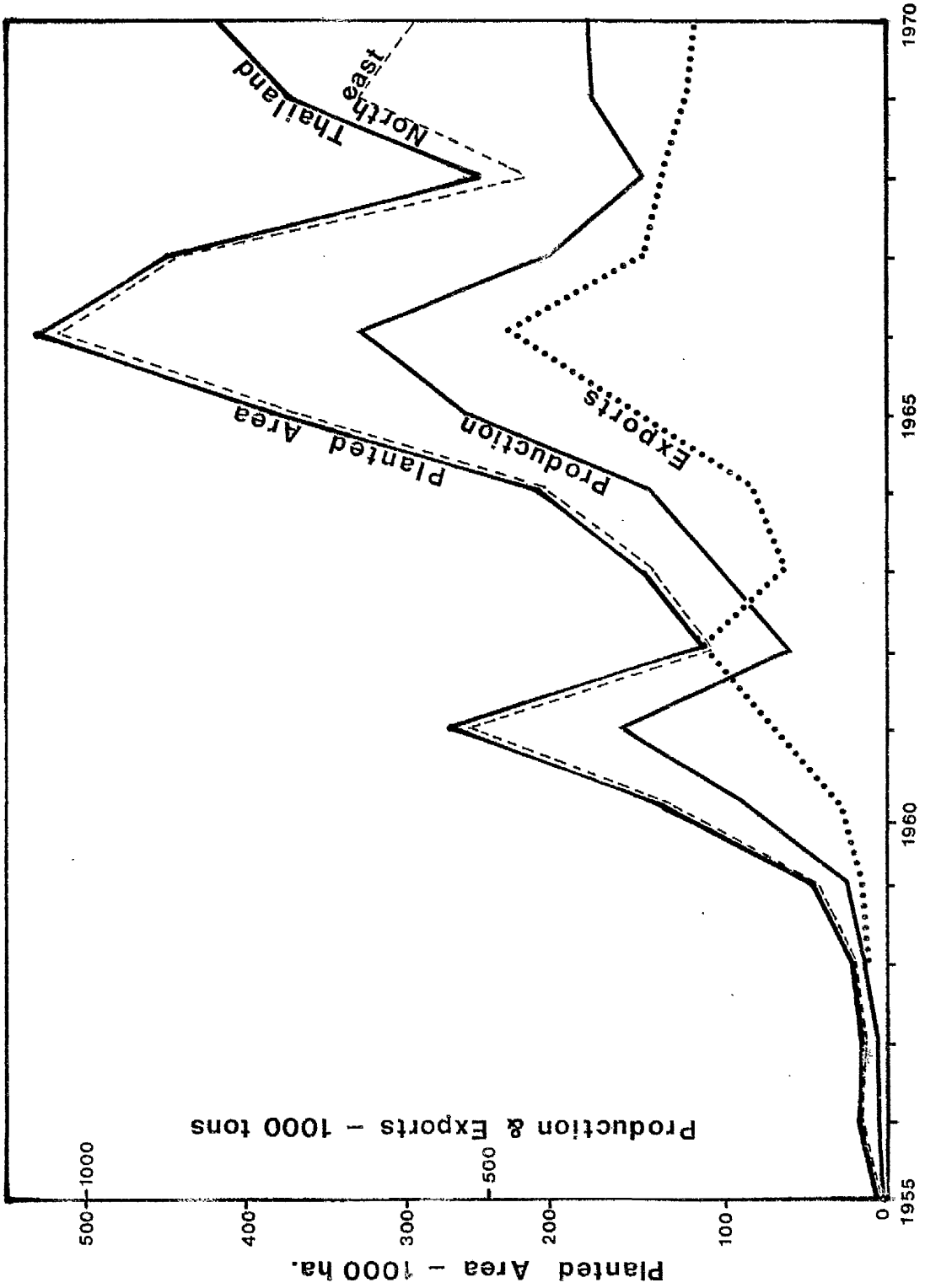
50. Thailand, Ministry of Agriculture, 1970, op.cit., table 28, p.67.

51. Thailand, Ministry of Agriculture, 1971, op.cit., Appendix table 5.

52. Silcock, op.cit., p.80.

Figure V.4: Trends of Kenaf Planted Area, Northeast Thailand, 1955-1970



Source: Agricultural Statistics of Thailand, 1970

In addition to these ecological problems in kenaf cultivation, the large-scale cultivation of the crop in Thailand's Northeast region is heavily dependent on the world marketing situation and the ability of the Thai industry to improve the quality of its fibre. The two problems are closely linked. World price fluctuations in the past decade or so have discouraged investment in the crop on the part of the Northeast farmers, which in itself means that the Thai crop is more difficult to sell.

Just as the initial impetus to the expansion of Thai production came from the failure of the Pakistan jute crop in the late 1950s, so it has been the rises and falls in production in India and Pakistan which have affected the livelihood of the farmers. Farmers have tended to respond to high prices in one year by planting more kenaf in the next, when prices may not have been as good and have suffered accordingly. Even though there is a growing domestic demand for gunny sacks in the country, running at about 40 million sacks annually,[53] this is insufficient to stabilise the price on the home market. Not being sure of his return each year, the farmer has been reluctant to make much investment in kenaf cultivation. Lack of fertilisation only helps increase the loss of fertility on the land and lack of attention to improvements in processing means low quality fibre.

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53. Louis Berger Inc. (Development Economic Group), op.cit., p. V-81.

Since kenaf is inherently inferior to jute as a fibre, the latter is in a strong position in the world market, and every effort must be made to assure high quality kenaf fibre in order to compete. The quality of the fibre from the Northeast of Thailand is still considered to be lower than the preferred level. Most of the kenaf grown is of the native varieties. Although Cuban kenaf was introduced as early as 1951, fibre quality and yield were good only when grown under the most favourable conditions, the plans proved highly susceptible to disease and were very unpleasant to handle at harvest.[54] Recently new Pakistani varieties have been brought in, but as yet their performance is uncertain.

The problem of fibre quality does not only lie in the variety grown. After harvesting kenaf requires soaking (retting) in order to remove the fibre from the stem of the plant. Here the quality of the fibre is influenced by the type, amount, and temperature of the water.[55] In much of the Northeast by the end of harvest season there is often insufficient water for adequate retting. Without providing special, expensive facilities, only at localities near running streams and rivers is the clean, running water required for good quality fibre to be found. Since at present the local marketing system gives no real premium for good quality fibre it can scarcely be expected that the farmer will invest in any special facility, and a government attempt

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54. Behrman, op.cit., p.141.

55. Sato, op.cit., p.48.

to control output with a 'standard quality test' in 1961 has largely been a failure.[56]

Such problems of quality control and price fluctuations do not suggest that the farmers of the Khorat plateau can look to kenaf with any confidence as a major viable cash crop in the future. Although the domestic market is likely to be able to absorb a certain amount of kenaf, the world market is insecure. Good years for Thai kenaf have depended on environmental disaster or political conflict in the Indian sub-continent; it seems likely that the possibilities of the latter event at least are now receding with the establishment and recognition of Bangladesh as an independent state. Low and fluctuating prices have discouraged investment and will continue to do so, with the result of poor fibre quality and deteriorating land. A contraction of kenaf acreage may be expected. In any case, as Silcock argues

> '... new crops will need to be sought in the long run, for kenaf can hardly be expected to compete indefinitely with synthetic packing materials.' 57

If problems of petrochemical supply intervene, perhaps kenaf's position will be improved, but even then there remains the problem of the jute market.

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56. Smith, Harold D., "Agricultural Production and Consumption Patterns Market Potential in Thailand", 1963, p.52.

57. Silcock, op.cit., p.181.

Developments outside the Agricultural Sector

The need for development in agriculture in the Lower Mekong Basin is emphasised by the relatively limited development in the non-agricultural sector of the economy. Throughout most of the Basin, industrial development has been restricted to small-scale processing of primary, mainly agricultural raw materials and such major industrial developments as have taken place in recent years have been outside the confines of the Basin itself in the two large urban areas of Bangkok-Thonburi and Saigon-Cholon.

Apart from those derived from agriculture, the raw material base for industrial development in the Lower Mekong Basin appears to be rather limited. It must be noted however that the area has not been fully surveyed for mineral deposits, neither in terms of metals nor of fossil fuel resources and until surveys are completed final evaluation cannot be made. What reserves do exist, with the possible exception of salt, seem in no way to rival the mineral wealth of the western hills of Thailand and their extensions into Burma and the Malay Peninsula.

One of the major raw material resources of the Basin is, however, its forests. Despite war devastation, vast areas of the four riparian countries are forest-covered and the many varieties constitute an important addition to national income. A large number of trees provide material for high-quality wood-work, notably teak, and others supply wood for use in agriculture and industry. Woods of poor quality are also used for

firewood, charcoal manufacture and the manufacture of matches. The paper and house construction indsutries are also important users of wood and furniture varnish from the lacquer tree is another significant product.

Despite these many users the commercial development of forestry in the Lower Mekong Basin as a whole has been on a scale much smaller than in Northern Thailand and Burma. Most of the forests have not been exploited on a significant scale because of transport difficulties. On the other hand, the area under forest is gradually declining largely as a result of the destructive agency of shifting cultivation turning to permanent cash cropping, the cutting of timber for domestic dwellings and extraction for fuel and charcoal production. Despite government regulations it is practically impossible to control the encroachments of the rural population. Commercial logging has also increased in recent years with the growing demand for wood of all kinds, despite some falls in the consumption of wood for household uses; in Northeast Thailand, for instance, the production of firewood and charcoal has been decreasing since 1966 at about 0.5 percent a year due to the increased use of kerozene, electricity and bottled gas in the cities.[58]

If transport problems have meant that the forest resources of the Lower Mekong Basin have only been slowly developed, they have also meant that little is known of the mineral potential of most of the Basin.

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58. N.E.D.B., op.cit., p.14.

Various small mineral deposits have been found, chiefly in Laos, where they include lead, tin, coal, copper and iron. Even before the arrival of the French, the Laos were digging shallow pits and smelting local ores in simple charcoal furnaces for local consumption. Under French patronage, however, production of tin especially rose rapidly from just 44 tons in 1913 to 1,600 tons in 1937.[59] This remains the most important mining enterprise in Laos, centred on the Nam Pa Thene basin in Khammouane province. In 1920 this area produced over 60 percent of Indochina's tin and despite the warfare production has continued to the present time. In 1964, the largest mine, the Phon Tiou mine under French ownership was producing an average of 800 tons and another 140 tons came from the nearby Nong Sun mine.[60]

In the other countries of the Basin, mineral exploitation has never reached the same extent as in Laos. The Khmer Republic's most important deposits are the reserves of iron ore at Phnom Deck in Preah Vihear province; these are believed to total some 4.8 million tons of high grade ore,[61] but transportation problems have prevented their modern exploitation. There are also significant coal deposits at nearly Phnom Ker. In the Northeast region of Thailand, there has been no significant exploitation of any mineral resources except for the manganese deposits of Loei

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59. Naval Intelligence Division of the Admiralty, op.cit., p.327.

60. UN, "Atlas of Physical Economic and Social Resources of the Lower Mekong Basin", 1968, p.42.

61. Ibid., p.41.

province, but even here production was very small and operations were halted in 1963. The Khorat Plateau as a whole is underlain by salt deposits and according to the Mekong Committee, "Reserves of the area are possibly the largest in the world",[62] but their exploitation requires an adequate industrial water supply and an increased world market demand for salt-based chemicals. At the present time the scale of operations is small and the method primitive, but local needs are satisfied. Salt is also one of South Vietnam's few significant minerals and until 1967 was an important export commodity. Here the salt is derived from the evaporation of sea water along the coasts of such provinces as An Xuyen in the Delta and Binh Thuan, Ninh Thuan and Phuoc Tuy north of Saigon. White sand deposits on the coast are also being investigated as raw material for the development of the glass industry.

The search for deposits of fossil fuels in the Lower Mekong Basin has so far been relatively unsuccessful. The only coal-field developed has been that at Nong Son in the Republic of Viet-Nam where reserves are said to amount to 3.5 million tons. Operation was discontinued before the Second World War because of lack of capital and the exhaustion of the surface beds, but the independent government recommenced working in 1957 with production rising to 80,000 tons in 1961 and 104,000 tons in 1963.[63] Since 1964 however

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62. Ibid., p.43.

63. Smith et al., op.cit., p.28.

operations have been suspended once again following Vietcong attack and the increasing difficulty of transporting the coal from the mine. Large deposits of lignite have been found in Laos in Luang Prabang, Phong Saly and Saravane provinces and these are being exploited on a small-scale to provide power for the Vientiane power station, but other thermo-electric plants in Laos burn charcoal which is limited and irregular in supply and gives a high cost of operation. Investigations for petroleum have taken place in some parts of the Basin, but no exploitable reserves have so far been found on land. Prospects are clearly better off-shore where Vietnamese territorial waters in the South China Sea and the Gulf of Thailand both give cause for optimism.

The lack of indigenous fossil fuel resources has meant that traditionally electricity generation in the region has depended on small-scale local generation from imported supplies of refined products. Some of the larger industrial installations, like the major rubber companies, operated their own private generators and in Vietnam the country as a whole was supplied by private operations of French-owned companies. Until recently all electricity in Northeast Thailand was generated in local diesel installations.

The growing demand for electricity has however forced the riparian countries to turn to their major resource for power generation, hydro-electricity. This is amply able to offset the deficiencies of lack of fossil fuels and a number of projects have already

transformed the power supply situation. Some of these have been built under the auspices of the Mekong Committee's tributary project developments and will be discussed in more detail below. It may be noted here that the construction of Nam Ngum in Laos, of Nam Pung and Nam Pong in Northeast Thailand and the linking of the latter area into the Thai national grid in 1970 have already had a very beneficial effect on those parts of the Basin, while the Drayling plant is already making an important contribution in Vietnam.

Industrial Development

The development of these new and more regular power supplies in the Lower Mekong Basin has been too recent to have had a marked impact on the industrial structure of the region. Most industry in the region still consists of small-scale light manufacture and agricultural processing and most of the modern industries in the riparian countries as a whole have been established in the capital cities. The industrial base in general suffered damage in the Second World War and in the three countries of Indochina this has been a lasting problem since independence.

Vietnam has been the most industrialised part of the Lower Mekong Basin but even those industries developed under the French colonial administration were mainly located in what is now North Vietnam. Here coal and other natural resources along with a greater density of population made a firm base for industry and the southern Mekong Delta had to import all its coal, paper, cement, textiles and glass from the North.

The industries in the south on the other hand were mainly based on agriculture - rice mills, distilleries, breweries and soft drink plants, sugar refineries, saw-mills and factories for the initial processing of rubber.

Since 1954, of course, the south has been effectively cut off from the larger industries of North Vietnam and attempts to restore the imbalance have had to be made. Some development of small industries manufacturing consumer goods was achieved in the immediate post-independence period, but even then the slow growth of the agricultural sector slowed down developments. By 1960 industry still contributed only a small proportion of the national wealth and since then any further attempts at industrial growth have been severely hampered by the war. Destruction of new infant industries has resulted in increases in imports in many consumer goods notably textiles which Vietnam could expect to manufacture herself and irregular supplies of agricultural produce and poor communications only add to the difficulties. In the poor security situation most operating plants are located in the capital city of Saigon.

Vietnam was also the manufacturing centre for the other parts of French Indochina in the pre-independence period and consequently the industrial base of Cambodia and Laos was extremely limited on independence. Since then the rate of industrial growth in both countries has been rather slow. The Khmer Republic has managed to attract a number of new foreign enterprises, mostly heavily financed by foreign aid.

To reduce the country's dependence on the Mekong River and South Vietnam, the port and industrial centre of Kompong Som (then Sihanoukville) was opened in 1956.[64] This has accumulated a number of new industries, a cement works, brewery, palm sugar refinery, cotton-ginning plant and beginning operations in 1968 an oil refinery.

By contrast the scope of industry in land-locked Laos is very small even now. There is a lack of skilled labour and particularly of modern transportation facilities. The domestic market is very small and widely scattered. There is little available capital other than from foreign loans. It is anticipated that Laos has rich mineral resources which could be significant for future development and there is undoubtedly a good market for her tin and timber products, but at present the industrial base remains limited in size and location, with a few plants like saw-mills, match, cigarette and soft-drink manufacture clustered around Vientiane.

In Thailand, industrial expansion has gone ahead more successfully than in the other riparian countries. Before 1930 manufacturing in Thailand was limited to rice-milling and saw-milling, but new industries were introduced before World War II beginning with textiles, paper and sugar manufacture. Since 1959 particularly there has been a significant increase in the inflow of foreign capital into Thailand and manufacturing industry

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64. Steinberg, op.cit., p.28.

has grown at 12 percent annually.[65] Manufacturing has increased its share of national income from 11 percent to 14 percent and the share of consumer goods in total imports has consequently decreased. The sugar, cement, cotton textile, glass and tobacco industries have all become established and new industries have been set up. These developments have occurred mainly in the Bangkok area however, and the Northeast region, located far from the centre of consumption, without the skilled labour of the Bangkok region and with power costs still high when compared to Bangkok, has been relatively unaffected. Kenaf production in the area has led to the development of a number of gunny bag factories, but these are only a small addition to the traditional base of rice-mills, saw-mills, ice factories and small food-processing establishments.

Industry in the riparian countries is still therefore concentrated in the capital cities. Where little capital is available, it is essential to concentrate resources at points where the growth response will be greatest, that is at the capitals, which are also often the main ports - Saigon, Bangkok, Phnom Penh, and where there exists the greatest market.

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65. Thailand, ASRCT, "A Description of the Industrial Sector in Thailand", Appraisal Report No. 13, 1968, p.5.

Despite the decrease proportion of the population engaged in agriculture in the Basin, this has been mainly a feature of the war conditions in that many people have sought refuge in the cities and have taken up jobs in the service sector. These have frequently been an inefficient form of employment with a whole family or group of friends often doing job essentially only capable of employing a single person. Other jobs, particularly in Saigon and some towns of Northeast Thailand like Ubol Ratchathani, Udorn Thani and Nakhon Ratchasima, have been closely linked to the American war effort in Vietnam and are likely to disappear with their withdrawal from Indochina. The manufacturing sector of industrial employment has scarcely expanded and indeed may well have contracted in view of damage caused to plant in the war, particularly in Saigon and Phnom Penh.

Those industries which do exist in the capital cities are frequently capital intensive rather than labour intensive, as for example at the newly established port of Kompong Som which the Cambodian government has developed since 1956 with plants for rubber tyre manufacture, palm sugar refining, oil refining, etc. Outside the capital cities and ports, existing industries consist mainly of raw material processing plants dealing with traditional agricultural produce, forest products and primary minerals. Here again, overall employment is limited; most of the rice-mills and saw-mills are family concerns. Rubber factories are attached to their respective plantations and again provide little employment.

It seems unlikely therefore that industrial expansion in the capital cities will in the future take place at the rate capable of absorbing the existing reservoirs of disguised unemployment already in the urban areas. In the regions, locational disadvantages seem likely to confine industrial development to raw material processing. The existing narrow range of crops and other raw materials will have to be expanded if successful development of this type of industry can be maintained. It may be that other mineral resources will be discovered, but the main resources for local manufacturing would seem to lie in a diversification of the agricultural base.

CHAPTER VI

AGRICULTURAL DEVELOPMENT POLICIES

Although the close adaptation of rice cultivation practices to environmental conditions through the years has improved the productivity of agriculture in the Lower Mekong Basin and a number of cash crops have been introduced, the structure of the agricultural economy has changed little. The farmers still have to face the risk of crop damage every year and there are also problems of cash crop development. The shortage of labour for rubber plantations, the difficulty of financing re-planting of high-yielding clones and the severe competition from synthetic rubber make it impossible for the individual holdings to develop rubber planting. Narrow markets are a problem for the development of maize exports, but high moisture content makes for poor quality produce and prevents the widening of the market. The production of kenaf in the Northeast of Thailand is subject to fluctuations according to the demand from the Indian sub-continent and the jute production of India and Bangladesh. Outside agriculture, raw material and power deficiencies in the Basin give only a limited opportunity for industrial development.

In these circumstances the problems of agricultural development in the rural areas are the problems of the countries as a whole. The rapid growth of population and the desire for rising living standards in the countryside have emphasised the need to increase production of both food and export crops. The urgency of

this situation and the need throughout the Basin for re-construction after World War II has led to government intervention in the economy since that time and each of the four riparian countries has drawn up national economic development plans to guide progress. A number of these have been thwarted by the continuing war situation, especially in the Khmer Republic and South Vietnam, but the attempts have continued. In the present chapter the character of these attempts at national economic planning will be examined in order to provide the context for the role of international co-operation in the development of the Lower Mekong Basin.

Thailand: The Overall Strategy

Before World War II, the Thai government had not had a very important role in the development of the economy towards greater productivity. Economic growth depended on the steady expansion of a few primary products, rice, tin, teak and rubber, which were largely in the hands of private enterprise. Government expenditure was primarily allocated to defence and general administration, with a small proportion being used for infrastructural developments like highway and railway construction. After World War II a number of economic problems arose and the country experienced some period of depression notably with the decline of primary export prices in 1953 and 1957 and the fall

of agricultural production in 1957-8.[1] Nevertheless the recovery and expansion of production testified to the growth potential of the country and the National Economic Council, established in 1950, sought to accelerate growth.

It was with this object and under the recommendation of the Ministry of Finance, the Bank of Thailand and the National Economic Council that in 1956 the government drew up the First National Economic Development Plan (1961-66) with advice from the World Bank.[2] The plan was not intended to change the economic structure of the country, but rather to mobilise existing resources for optimum utilisation in expanding productive capacity and national income. At the same time it was anticipated that this would enhance national security and political stability. The overall target was to increase GNP at 6.0% annually and the average annual growth of per capita income at a rate of 3.0%.[3] The plan emphasised investment in economic infrastructure and social development along with agricultural development. The agricultural sector received about 14% of total investment, but resources were mainly concentrated in providing the infrastructure necessary for economic development and most of the programmes were concerned

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1. N.E.D.B., "The National Economic Development Plan, 1961-66, Second Phase 1964-66, 1964, p.1.

2. N.E.D.B., "Summary of the Third National Economic and Social Development Plan, 1972-76", undated, Introduction.

3. N.E.D.B., 1964, op.cit., p.34.

with the construction of basic facilities - the national highway system, irrigation systems - and the promotion of technical knowledge and the improvement of human resources. It was hoped to expand economic activities in the private sector through public development expenditure and the government made every effort to attract private investment funds and maintain the nation's financial stability.

The First National Economic Development Plan was divided into two phases, 1961-63 and 1964-66. This was designed to improve the performance of the second period in the light of the experience of the first. The overall objectives of the first period were achieved satisfactorily and the second period was then re-assessed with the major goal of increasing per capita real income at the rate of not less than 3% annually. A balance between public and private sector investment was sought with

> "The expansion of economic activities in the private sector through public development expenditures in power, irrigation, communications, agricultural extension, community development, education, public health and various social services .... a key development policy." 4

The success of the First Plan meant that at the beginning of the Second Plan (1967-71) Thailand was in the position to accelerate economic and social development. Under this plan the target was to increase per capita income by about 5% per annum.[5] The maintenance

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4. Ibid., p.b.

5. N.E.D.B., "The Second National Economic and Social Development Plan (1967-1971)", p.27.

of economic stability was still an urgent problem, but a special emphasis was placed on the reduction of regional and sectoral inequalities in the society. Regional planning was stressed to accelerate development in the remoter areas and the plan included a policy of promoting employment and developing manpower resources, especially in the countryside.

The objectives of the Third Plan (1972-76) continue to emphasise the importance of rural development, but also cover family planning and employment and the expansion of planning in the private sector. The target of the Third Plan is to increase GNP by about 7% per annum. Though this target is lower than the First and Second Plans, the policy to reduce the population growth rate to only 2.5% annually will effectively raise per capita income growth to 4.5% per year. Agriculture is maintained as the most important sector in the Third Plan with a target increase of 5.1% annually.[6] Construction of major projects has been reduced and expenditure is to be distributed for greater direct benefit to the farmer with the construction of farm level irrigation distribution networks and village roads. In the social sector the provision of social services was still limited after the Second Plan and there remained large inequalities of living standard between the regions, so that in the Third Plan the government has also emphasised the distribution of social services to the rural population,

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6. N.E.D.B., "The Third National Economic and Social Development Plan, 1972-76", p.31.

increased construction and electricity provision in the rural areas and the expansion of basic education and public health services.

Although industrial employment remains on a fairly small-scale in Thailand, industrial expansion has been an important objective of the development plans. Private investment from both domestic and foreign sources has been encouraged by the creation of a favourable economic climate. The importance of agriculture in the economy has therefore declined as a result of changes in the economic structure since the implementation of the First Plan. The percentage of agricultural output in the national product has declined as the other sectors of the economy, services including trade, industry, mining and construction have expanded. The increased importance of industry in the economy testifies to the success of the industrial development programmes. Nevertheless agriculture is still the dominant sector of the economy and still constitutes one-third of the country's national product. As the most vital economic activity for the majority of the population, the first priority in the development plans remains to promote increased agricultural production of a higher quality.

Planning for Agricultural Development

The primary objective of government planning in agriculture in Thailand has been to increase productivity, diversify and balance agricultural production and develop remote rural areas. Development expenditure on agriculture rose from 14% of the total First Plan expenditure to 20% under the Second Plan, but is to fall again to

TABLE VI.1

GOVERNMENT DEVELOPMENT EXPENDITURES ON NATIONAL PLANS

THAILAND

Sector	Actual 1961-66		Planned 1967-71		Planned 1972-76	
	Million bahts	%	Million bahts	%	Million bahts	%
Agriculture and Co-operative	3,900	13.9	11,360	19.8	13,695	13.7
Industry and Mining	2,340	8.3	915	1.6	1,480	1.5
Transport and Communications	7,360	26.1	17,100	29.7	19,475	19.4
Power	4,740	16.8	4,970	8.6	7,875	7.8
Commerce	-	-	180	0.3	870	0.9
Community Facilities and Social Welfare	5,560	19.7	10,270	17.8	17,630	17.6
Public Health	1,060	3.8	2,570	4.5	6,340	6.3
Education	2,080	7.4	6,605	11.5	32,910	32.8
Others	1,140	4.0	3,550	6.2	-	-
Total	28,180	100.0	57,520	100.0	100,275	100.0

Source: The National Plans, N.E.D.B.

14% under the Third Plan (see Table VI.1). Following the general belief in allowing the free play of market forces in the structure of the economy, in the First Plan the work of government agencies was restricted and the main aim was to create favourable conditions for the private sector. Opportunities for the benefit of the individual were to be provided with no restriction on private enterprise and initiative. Investment in irrigation, crop promotion, agricultural extension and research has aimed to promote private efforts in agriculture and to give higher returns to the cultivators and the economy through increased output per unit area, diversified and better quality crops and more favourable returns.

Thus from the First Plan the development of agriculture through the building of infrastructure - irrigation, in the form of storage dams, reservoirs and water tanks, power facilities and road construction both of national highways and village feeder roads - was stressed. The extension of irrigation and flood control were seen to be the main factors to bring about an increase in paddy production and of crops grown in rotation with rice. The basic structures of many irrigation projects have been completed, but they will be fully operational only when the irrigated areas have a complete system of water distribution and have received the benefits of agricultural research and extension. Following the heavy investment budgets under the First and Second Plans, the construction of large dams in the

Third Plan has given way to other projects and to a stress on the completion of the water distribution systems in those already built. Table VI.2 shows the expansion of the area under irrigation during each plan.

In co-ordination with the development of water resources, agricultural research stations have been established to promote, introduce and diffuse new crop varieties. Agricultural extension services have been improved in quality and the number of officers expanded in order to introduce modern techniques through experimental and demonstration plots. In livestock development, the policy has concentrated on the improvement of rearing methods and disease control in order to encourage the farmers to breed more pigs and poultry of good strains to meet market demand. The aim has been to improve quality rather than quantity. Many livestock stations have been established, including the dairy station at Muak Lek (Saraburi) that was founded as a Thai-Danish joint venture during the First Plan.[7] For fisheries, the promotion of fresh-water fishing has been set in motion through the introduction of fish-farming techniques in ponds and rice fields and in areas under perennial irrigation, as well as through the extensive distribution of fingerlings of different varieties. To date, some 14 inland fishery stations have been set up.[8] The aim and the Royal Forestry Department has been to conserve forest water-shed areas as well as designated

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7. The First Plan, Second Phase, op.cit., p.70.

8. The Third Plan, op.cit., p.240.

TABLE VI.2

THE EXPANSION OF IRRIGATED AREA, THAILAND

1960-1971

(thousand hectares)

Year	Tank Irrigation	Other Projects	Total
1960	28.8	1,497.0	1,525.8
1961	33.6	1,534.0	1,567.6
1962	36.8	1,608.6	1,645.4
1963	40.0	1,635.9	1,675.9
1964	40.8	1,685.6	1,726.4
1965	48.0	1,708.3	1,756.3
1966	52.8	1,734.5	1,787.3
1967	52.8	1,759.4	1,812.2
1968	68.1	1,801.9	1,870.0
1969	70.9	1,920.8	1,991.7
1970	85.8	2,032.9	2,118.7
1971	87.0	2,041.1	2,128.1
1976 (Planned)	...	...	2,840.3

Source: Annual Statistical Bulletin, Mekong Committee, 1972

The Third National Economic and Social Development Plan, N.E.D.B.

preserved forests and to carry out re-afforestation in the water-shed areas where the surrounding forests have been destroyed. A laboratory for forest and timber products has been established with West German assistance. The government has also been encouraging private enterprise to grow soft woods for industrial purposes, a policy which at the same time assists the government's conservation and re-afforestation programmes. In addition to these technical projects there are plans for land reform to ensure an average holding size of not less than 25 rai;[9] redistribution is planned through the development of farmers' co-operatives. A land survey and classification programme, soil fertility surveys and soil mapping are planned, the result of which should be the expansion of the cultivated area in the future on a more scientific basis.

Planning in the Northeast Region

Since the Northeast region is the problem region of the country - the biggest but poorest region with an average per capita income only one-half of the national average and, in addition, inadequate water supply and transport facilities, - a Northeastern Development Committee was organised to take charge of development policy. Under the First Five-Year Plan, a community development programme was included for every province in the region. This was mainly concentrated in the 11 border provinces closest to the unsettled

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9. The First Plan, op.cit., p.52.

political situations in Laos and Cambodia; here the Accelerated Rural Development programme was initiated to improve living standards, but with a clearly defined political objective

> "to increase the development potential in the remote areas and prevent subversion and inflation." 10

The Second Five-Year Plan included a special plan of development for the economically backward areas of the country which, of course, included the Northeast region. About one quarter of the total special regional development budget for the Second Plan was allotted to the Northeast and in addition a number of special budgets have since been provided to accelerate the programme, mostly for research and agricultural promotion. For large projects that require a large amount of investment there has been support from foreign loans and grants. Under the Second Plan a regional centre for economic planning administration was established in Khon Kaen.[11]

Despite these programmes the situation of the Northeast region in relation to the rest of the Kingdom did not improve in the period 1967-71. Per capita income of the Northeast increased at only 2.8% while the growth rate of the Central Region was 6.0%.[12] At the same time social problems in education, public health and social security in the rural areas have accelerated migration to the urban areas and have increased

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10. The Second Plan, op.cit., p.71.

11. Ibid., p.65.

12. The Third Plan, op.cit., table 2, p.169.

social problems in the cities, so that the government resolve to develop the Northeast continued under the Third Plan. Here the emphasis is on the development of human resources, industrial expansion, especially in agricultural processing, and raising the standards of education and public health services. Following the infrastructural developments of the Second Plan, it is hoped now to increase the production of cash crops at 3.6% annually, and rice at 2.8%,[13] while the principal industrial developments will be in the processing of livestock products, sugar, kenaf, tobacco and cotton.

In agriculture, the aims for the Northeast have been similar to the countrywide strategy of each Five-Year Plan, but there have been a number of projects specific to the region. Since the Northeast's main problem is water supply, there has been a particular concentration on the construction and re-construction of irrigation facilities. Following the completion of these the next step is to increase agricultural production, especially in the irrigated areas to meet domestic and external markets through research, experimental work and extension service development. Improvements in transportation, marketing and agricultural processing are also a high priority.

Despite the fall in the rate of growth in GDP in the Northeast in 1968-70, it is felt that there is a large opportunity for agricultural development in the region. The introduction of new crops to reduce the dependence on rice and to increase farm income is already being encouraged. Agricultural development projects at

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13. Ibid., p.180.

Lam Pao, Nam Pong and Manchakiri, as well as the Northeast Agricultural Centre at Khon Kaen are all helping to introduce and train the farmer in the new techniques of production.

For rice the aim is to increase the yield per unit area and so decrease the area of marginal land being used for paddy. Research work on new varieties suitable to the environmental conditions of the Northeast capable of increasing yields by at least 10% over local varieties is being undertaken by the rice experimental and research centres of which there were six in the region by 1971.[14] Other programmes at these centres include research into rice disease protection and crop rotation. Work at other agricultural stations concentrates on dry foot crops particularly those with high export potential. A mechanization centre to be established at Kalasin under the First Plan to help the farmers in methods of clearing and ploughing upland.[15] In the case of cotton, a disease and insect control project has been developed and there has been an expansion of cotton acreage in Loei, Khon Kaen, Udorn and Nakhon Phanom provinces; under the Third Plan, new cotton varieties will be distributed to the farmers. In this period too research on developing new kenaf varieties by cross-breeding local and Cuban varieties is being carried out and Pakistani upland jute has also been introduced. The government is also encouraging planting mainly in areas near water resources and the

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14. Ibid., p.232.

15. N.E.D.B., Northeastern Development Committee, "Northeast Development Plan 1962-66", 1962, p.50.

foundation of new gunny bag factories at Nakhon Ratchasima, Khon Kaen, Chaiyaphum, Mahasarakham, Kalasin and Ubon. The maize and sorghum research centre at Pak Chong, Nakhon Ratchasima has been the centre for the demonstration and distribution of maize varieties new to the Northeast like Phrabutthabat-5. There is also a project on double-cropping of maize at Nakhon Ratchasima.

Most of the livestock development projects in Thailand have been centred in the Northeast which produces almost half the national production. With vast potential pasture resources to be developed in the area there is considerable opportunity for expansion of livestock rearing. The plans emphasise, however, not only increasing production but improving quality. To accelerate the spread of animals with good breeding characteristics, livestock husbandry stations have been established in six provinces. The largest is at the regional agricultural centre in Khon Kaen (Tha Pra) which focuses on animal breeding.[16] Further work on pasture improvements has been carried out at Khon Kaen University and at Borabue (Mahasarakham) with the help of Australian and New Zealand experts. To improve stock quality and distribute high quality animals to the farming population artificial insemination stations have been set up at Nakhon Ratchasima, Khon Kaen and Ubon. The main target of the research into animal disease control is the eradication of such dangerous diseases

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16. Ibid., p.55.

as foot-and-mouth, rinderpest and anthrax and the Pak Chong vaccine and serum centre is being expanded for this purpose. A pig-breeding centre has been set up and where there is adequate water supply the government is promoting the improvement of duck farming.

For fishery development there are surveys of potential fishing areas, research programmes to improve methods of handling, distribution and processing and to restock irrigation tanks and reservoirs. Six fishery stations have already been set up with plans for expansion to all provinces.[17] Though there is little really valuable forest in the Northeast, large areas nevertheless remain under woodland. The need for planned forestry development is largely due to the high rate of timber cutting both for firewood and construction which has been faster than the rate of replacement and which leads to subsequent damage by soil erosion, storm and flood. Deforestation in the Northeast is now being controlled. Patrol units have been set up for forest protection and re-afforestation is being accelerated. Forestry research is focussed on watershed management and the Forestry Department aims to retain a reserved forest area of about 40 million rai in the Northeast.[18] At Si Sa Ket, forest conservation and afforestation is designed to produce raw material for a paper factory and there is a programme for planting of higher yielding lac-farms. Many forest areas such as Khao Yai (Nakhon

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17. Ibid., p.32.

18. Ibid., p.33.

Ratchasima), Phu Kradoung (Loei), and Phu Pan (Sakon Nakhon) are reserved as national parks and there are two wildlife refuge areas at Pha Dong Lan (Khon Kaen) and Pha Lam Narai (Chaiyaphum).

Development Planning Policy in Laos

Since the beginning of the French administration in Indochina, the economic development of Laos has always lagged behind that of Cambodia and Vietnam. Expenditure were always higher than revenue in the internal budget and international payments were greater than foreign earnings, but the deficits were offset by the surplus derived from Cambodia and Vietnam.[19] Since independence budgetry deficits have been met through the American and French aid programmes. Indeed Laos receives the highest per capita total of United States aid of all recipient countries in the world.[20] Most of the Lao economy and government budget continues to be based on aid. The government has tried to improve the climate for private and foreign investment, but the lack of the basic infrastructure needed for economic growth, especially of communications links, the inadequate; managerial, technical and mechanically skilled labour force and the limitation of the marketing and distribution system all retard the pace of investment. The uncertainty of the political situation and the impediments of physical geography are also obstacles to change

19. LeBar, Frank M. and Suddard, Adrienne (eds.), "Laos, its people, its society, its culture", 1963, p.157.

20. The Economist Intelligence Unit. "Quarterly Economic Review, Continental Southeast Asia", No. 1, 1969, p.21.

and to raising the standard of living.

Clearly the aim of economic development planning in Laos has been to set the economy on a viable footing and she has sought to use the continued foreign aid as a means of improving the productive base in both urban and rural areas. A development plan was drawn out initially in 1952 with the emphasis on agricultural production, development of transportation and communications and of government services, but the Indochina war and internal crises in Laos itself prevented its implementation. Nevertheless a National Planning and Foreign Aid Council was set up in 1956 and in 1959, a Five-Year Plan for Economic and Social Development was promulgated by the Phoui Sananikone government.[21] During its first two years this plan stressed social development with economic development emphasised in the last three years. With the support of foreign technical and financial assistance, the major objectives were the development of agriculture and livestock to ensure adequate food supply for the whole country, increased production of goods for export to improve the country's balance of payments, transport and communications improvements, the development of local raw materials and the foundation of industries based upon them and the raising of standards of education and public health facilities. A survey of indigenous natural resources was also to be set in motion and the plan also stressed increasing trained personnel and fostering private investment. Some progress was made under the plan, but it was far

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21. LeBar and Suddard (eds.), op.cit., p.160.

from achieving its goals. Poor security and the unsettled political situation since 1960 have slowed down all development projects.

A five-year plan, the Economic and Social Development 1969-74, was adopted by the government in March 1969. This plan, involving a total investment of 59,079 million kip, again gave priority to agricultural production. In the still disturbed security situation the plan was designed.

> "'to be more than indicative but less than imperative' with considerable allowance for flexibility. It represented a broad attempt to eliminate or minimize such structural disequilibria as the preponderence of subsistence agriculture, the underdeveloped state of the manufacturing sector, and the continuing budget and trade deficits." 22

The continuing hostilities have meant, however, that little has been achieved.

Despite the stress on agriculture, during the period of fighting, agricultural production has been unable to meet the consumption demand due to the increasing numbers of people in military activity and the movement away from the fighting from the rural areas into non-agricultural occupations. Where there has been a rice deficit situation the lack of marketing infrastructure has made it impossible to bring supplies from the surplus areas.

On the other hand the government has been seeking to improve the situation. Rice is the staple food of the country and it has been a focus of the programmes

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22. Whitaker, Donald P., "Area Handbook for Laos", 1972, p.213.

of agricultural development. The government took over the agricultural experimental stations and plant disease control facilities operated originally by the French and in 1967 the Bureau of Agricultural Research made the increase of rice production a priority goal. Rice fields at the Asian Development Bank (ADB) financed Salakham Research Centre near Vientiane have been planted with new rice strains that are bred from native Lao rice and high-yield varieties from IRRI. The improved seeds are being distributed to the farmers.[23]

Other research stations have been set up to develop the cultivation of non-rice and particularly horticultural crops. These include the stations at Paka Nhoung and Tha Ngone on the Vientiane Plain, P.K. 20 and Pakson on the Bolovens Plateau and stations at Xieng Khouang, Luang Prabang, Sayaboury, Savannakhet and Pakse.[24] All these stations operate under non-irrigated conditions and the lack of trained personnel and the shortage of funds has tended to limit their effectiveness.

To transmit the work of the research stations to the farmers a number of programmes have been established. The Agricultural Extension Service was founded in 1956 with special emphasis on new rice seed and

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23. Embassy of the United States of America, USAID Mission to Laos, "Facts on Foreign Aid to Laos", 1971, p.140.

24. U.S. Department of the Interior, Bureau of Reclamation, "Pa Mong Project - Lower Mekong River Basin", Phase I Report, vol. 4, Appendix IV, 1966, p.143.

fertilizer distribution.[25] Since 1962 this has been been extended to the spread of vegetable seeds and farmers have increased their planted area of vegetables. Rural adult education also began under the auspices of the Service in 1961, but this programme was interrupted by the 1962 revolution.[26] In 1964, the Agricultural Development Organisation was set up again to distribute improved rice seed to the farmers, but its activities have expanded into the fields of rural credit supply, sale of fertilizer, insecticide and farm equipment, warehousing and the distribution and marketing of rice. Between 1965 and 1968, six provincial bureaus were established to manage the credit sale of fertilizer, insecticide and farm machinery[27] and in 1969 the Mechanized Farming Loan Fund was created to provide five-year loans for farmers to buy machinery for cultivation in areas of labour shortage, especially in the Vientiane Plain.[28]

Further increases in rice production can be achieved by the intensification of wet season cultivation through the development of small-scale irrigation systems and this too has been an aspect of government

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25. Embassy of the United States of America, USAID Mission to Laos, op.cit., p.142.

26. U.S. Department of Interior, Bureau of Reclamation, op.cit., p.146.

27. Embassy of the United States of America, USAID Mission to Laos, op.cit., pp. 146-147.

28. Ibid., p.149.

policy. The irrigation schemes have mainly been simple and easily constructed. With the assistance of the USAID programme over 170 small projects have now been constructed which can also irrigate some 9,400 ha. for second crop cultivation in the dry season. The project sites have been selected according to political, security and economic considerations. Some are provided with pumping facilities. One example of these projects is the Nam Tan scheme which was started in 1967 with the aim of reducing the rice deficit in the Luang Prabang area. The distribution canals were completed in 1971 and the project will irrigate 3000 ha. for paddy in the wet season and 1000 ha. for other crops in the dry season.[29] The government is also to provide 3 ha. of land for each new family in that area.

These irrigation projects were developed under the Rural Self Help programme first introduced by USAID in 1962.[30] A Commissariat for Rural Affairs was set up under the Ministry of Social Affairs and the government contributes services at the provincial and district level. The main purpose of the programme is to stimulate mutual aid and co-operation among villagers in agriculture, irrigation, community education, teacher training and public health.

In livestock development, since 1957 three livestock stations have been established on the Vientiane

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29. Ibid., pp. 144-145.

30. Ibid., p.109.

Plain, one for pigs and two for poultry. The new breeds of pigs and poultry are already being distributed. A veterinary service has been developed to control disease, improve breeding and inspect meat and skins. Improved feeding practices have been under experiment at the Vientiane Swine Co-operative which was organised in 1970.[31]

Since 1966, after the extension services had demonstrated fish cultural methods and had showed that fish is not only a good source of protein but also a source of additional income, the number of fish ponds has increased rapidly, especially in Xieng Khouang. Fish culture in paddy fields has also been pushed to try to increase fish production. The most important fish hatcheries are in Vientiane, Pakse and Luang Prabang, all producing fry to stock fish ponds.[32] Forestry plays an important role in the export economy of Laos and the government has taken responsibility for the administration and control of the national woodlands, for protection of forests by the creation of reserves and for re-afforestation with valuables species like teak. Loans are provided to the logging companies.

For all these efforts progress in Laos is still held back by the fundamental shortcoming of transportation facilities which remain inadequate to serve the needs of a developing economy. Since the country has no railway, it must depend mostly on roads, waterways

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31. Ibid., p.146.

32. Ibid., pp. 145-146.

and air transport and in the rainy season transport by road and air are often impossible, so that the travel by water is the only means and the Mekong particularly becomes the major routeway of Laos. Efforts to develop land communications have met with little success. During World War II and the Vietminh campaigns, many roads and bridges were destroyed and in 1954 a large part of the reconstruction budget was allocated to road and bridge building. Since then many programmes for improving transport and communications have been drawn out but they have not progressed as intended, despite the receipt of much aid in this sector from the U.S.A. and France. In 1955 there was a United States programme to build a road from Vientiane to Luang Prabang with a branch to Xieng Khouang the extension of the French-built Route 13 from the Cambodian border to Vietiane.[33] By 1965 this had deteriorated in many places and had to be rebuilt before re-opening. The French sought to improve the highway from Vientiane to Savannakhet, but this was never completed and the only other major highway is from Vientiane to the Mekong ferry crossing at Tha Duea which links to the Thai railway system. These transport deficiencies continue to hamper all development efforts in Laos.

The Khmer Republic: General Planning Strategy

Since independence in 1954, Cambodia has drawn up three official development plans, a Two-Year Plan

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33. LeBar and Suddard (eds.), op.cit., p.216.

(1956-57), the First Five-Year Plan (1960-64), and the Second Five-Year Plan (1965-69). The government's general policy has been to strengthen the agricultural base through modernisation and diversification and diminish the country's dependence on foreign manufactures that can be produced domestically. Although not dependent on aid to balance its budget, Cambodia has accepted considerable foreign technical and financial support both from the West and from the Communist world. Prince Sihanouk's policy was basically that

> "Cambodia would accept any and all foreign aid as long as it did not threaten Cambodia's sovereignty." 34

In the first few years after independence the aid came largely from the United States, but American involvement in Indochina led to that aid being renounced in 1963 and until the fall from power of Sihanouk the Communist powers, particularly China, took over the American role.

The government launched its first attack on the economic problems of the country in the Two-Year Plan. This put an emphasis on the expansion of transport and communications facilities, development of irrigation and flood control systems, progress in health and education and the development of small private industrial enterprises. As in the Thai first plan, the basic aim was to build up the economic infrastructure of the nation.

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34. Norodom Sihanouk's speech to the National Assembly in February 1956 quoted in David J. Steinberg, "Cambodia, its people, its society, its culture", 1959, p.234.

Out of a total expenditure in the plan of 2,455 million riels, about 62% came from United States aid, while the government itself supplied only 16-17% mainly from the Royal Office of Co-operation and the National Development Bank.[35] The plan's goals were not attained within the allotted time of the plan and this was therefore extended into 1958 and 1959.

Because of the extension of the Two-Year Plan, Cambodia's Second Plan did not begin until 1960. This was the much more comprehensive First Five-Year Plan which followed the broad framework laid down in its predecessor and drew from the experience gained in it. It sought to raise per capita income by up to 3% annually over the plan period.[36] Again its basic concentration was in infrastructure which received some 33% of the budget as against 35% for agriculture, industry and mining combined.[37] In addition, the government recognised the need to remedy the shortage of technically skilled manpower and instituted a training programme with facilities for engineering, agriculture, business and medicine. This plan did achieve some success in the industrial sector, with the construction of a number of factories and a particular growth in mixed economy enterprises combining private capital with public funds. The contribution of the industrial sector, including construction, in GDP grew marginally over the period of the Plan, but this was as much a reflection of the relatively unsuccessful methods to improve

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35. Ibid., table 5, p.259.
36. Munson, Frederick P. et al, "Area Handbook for Cambodia", 1968, p.216.

37. Ibid., p.217.

agricultural productivity and moreover

> "..... within the manufacturing sector the more basic (infrastructural) component (grew) faster than the output of saleable industrial commodities." 38

In the latter part of the Plan a growing shortage of foreign investment funds began to be felt with a deleterious effect on performance.

The Second Five-Year Plan, originally intended to follow the First Plan and extend from 1965 to 1969, was first deferred to 1967-71, but was inaugurated in 1968 and planned to run to cover the period 1968-72.[39] In seeking an average annual growth rate of GDP of 5%, this Plan placed stress on further diversification of the agricultural sector and an increased role for the private sector in industry and tourism.[40] Agriculture and industry each accounted for one quarter of the planned investment, while power, transport, communications and tourism together accounted for 35%. Several irrigation projects were planned to bring an area of about 135,000 hectares under irrigation. There were also plans to extend the area of rubber plantations by over 10,000 ha. and improve the quality and production of cotton.[41] Improvements of the managerial efficiency of the existing public and semi-public enterprises and the full capacity utilisation of existing plant by ensuring adequate supplies of agro-industrial materials was also stressed. Unfortunately these aims had to be

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38. Ibid., p.217.

39. The Economist Intelligence Unit, "Quaterly Economic Review, Indochina", Annual Supplement, 1972, p.22.

40. UN/ECAFE, "Economic Survey of Asia and The Far East", 1969, p.110.

41. Ibid., p.112.

abandoned almost as soon as they had been laid down following the major political upheaval in the country after the removal of Norodom Sihanouk in 1970. Since then the deteriorating security situation has effectively prevented any further planned development and the country has been forced into a state of dependence on United States aid to a greater extent than previously.

Agricultural Development Policies

For all the difficulties met in the implementation of the overall planning strategy in Cambodia, a number of significant developments have taken place in the attempt to modernise agriculture. When Cambodia was under French protectorate, the economy was oriented to growing of primary products for export to markets established by the French. Since independence, the government has made every effort to improve productivity of the major crops, rice, maize and rubber, by enlisting modern technology and improving organisation. Co-operatives have been established to market their surplus rice stocks for the farmers. Experiments with high-yield yellow corn have started to serve the regional market demand, notably from Japan, and local farmers have sought to use this to improve livestock feeding practices. The growth of the local palm and cane sugar industry has been encouraged and a state-owned sugar refining plant was established at Kompong Speu in 1965 to reduce the country's sugar deficit.[42] Sugar cane

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42. Munson et al, op.cit., p.229.

has also been introduced into the fertile area of Battambang province. In the rubber plantations which remain very important to the national economy, the government has tried to replace the Vietnamese workers who came to Cambodia under French patronage with Cambodians and loans and technical assistance have been provided for the establishment of small-holdings. To diversify the agricultural economy of the country other crops have been introduced under the plans; three tea gardens were set up in 1964-5 and the cotton acreage has been expanded to provide raw material for textile mills built under the First Five-Year Plan near Kompong Cham (1962) and at Battambang (1966) with Communist Chinese assistance.[43]

Requirements of water supply and water control for agricultural development have led to the introduction of small powered pumps in areas of low water table and under a five-year programme for flood control, drainage and irrigation, started in 1952, the construction of the dike at Cheang Prey and of the western Barai Basin project was completed again with United States aid.[44] Old irrigation and flood control facilities have been maintained and reconstructed with foreign technical and financial support.

The government has realised that research and vocational education are very important in the diversification and intensification of agriculture and two agricultural schools have been established, the Prek Leap

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43. Ibid., pp. 244-245.

44. Steinberg, op.cit., pp. 203-204.

School of Agriculture near Phnom Penh for vocational agricultural training and the National School of Agriculture, Animal Husbandry and Forestry in Phnom Penh for advanced agricultural education. Tonle Bati Community Education Centre, an important adult agricultural education centre was established largely with the funds of USAID. Many agricultural experimental stations have been founded, notably the Agronomy Service Station of Kok Patry, the Stung Keo Livestock Station (Kompot), and the regional agricultural stations at Battambang, Kompong Cham, Svey Rieng and Siem Reap.[45] These have undertaken a number of programmes to improve the quality and yield of certain crops again with foreign technical assistance.

Inadequate rural credit has also been felt to be a problem for agricultural development, as has the rural marketing system. The major reason for the creation of the Royal Office of Co-operation (OROC)

> ".... was the traditional reliance of farmers on moneylenders for short-term borrowings, including the rates allegedly charged by moneylenders, ...ranging from 35 to 225% a year" 46

After the establishment of the OROC in 1956, agricultural co-operatives were set up to provide credit for the farmers at low interest and at the same time to give them better prices for their crops. The Rice Purchasing, Processing and Re-conditioning Service seeks to purchase paddy from the farmers and mill it before export through the state trading agency, the National Import-Export

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45. Munson et al, op.cit., p.235.

46. Ibid., p.292.

Corporation which was created in 1964 to replace private trade firms which were mainly controlled by the Chinese. By mid-1966 there were 512 credit-granting co-operatives, 390 multi-purpose farm co-operatives, 14 specialised production co-operatives, 55 consumer supply co-operatives and 40 school co-operatives in the rural areas.[47]

Fishing is an important part of the rural economy of the Khmer Republic, particularly in the areas surrounding the Tonle Sap. The government has sought to regulate and control fishing developments in order to prevent over-exploitation of resources and improve marketing arrangements. The inland fishing areas are now classified and protected with regulations governing the methods of catch, the size of nets, the seasons for fishing and the type of fish which may be caught. The government receives revenues from selling fishing concessions to commercial fishing enterprises which are mostly in Chinese hands. In 1969 a governor was appointed for the Tonle Sap lake province to take overall responsibility for control of fishing in the lake.[48]

To develop animal husbandry, the government has launched a number of projects. To increase the population of large livestock experimental stations have been established with the Stung Keo breeding centre concentrating on selection programmes. There has been a drive to develop corn as an animal fodder, thus substituting corn

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47. Ibid., p.238.

48. Poole, Peter A., "Cambodia's Quest for Survival", 1969, p.25.

exports with exports of cattle and buffalo; in addition modern slaughtering and cold storage facilities have been developed. For the improvement of pig production a modern pig-breeding centre has been set up at the Prek Leap School of Agriculture.[49]

To preserve the country's forestry resources, most government-owned forests are reserved and cutting must be carried out under government lease. A fire-control and prevention institute is another help to conservation for which staff are being trained. There is some controlled exploitation of the forests by the authorities particularly to serve the government-owned plywood factory.

The Economic Development Policy of the Republic of Viet-Nam

Since independence, a good many social and economic development programmes have been inaugurated in the Republic of Viet-Nam. These began with the First Five-Year Plan during the rule of President Diem which was planned to run from 1957 to 1961 but which was never formally adopted. This was followed by the Second Five-Year Plan from 1962, but this too was abandoned due to the lack of security in the country. Since then most social and economic development programmes have been ad hoc responses to the prevailing internal situation; all have contained a major component relating to the main-

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49. Far Eastern Economic Review Yearbook, 1969, p.124.

tenance of internal order and indeed so much of the government's efforts and resources have been spent on the battlefield that there has been a relative neglect of purely economic and social welfare programmes, especially in the rural areas.

The economy of Vietnam since independence has become steadily less self-supporting and it has now deteriorated to the extent that it is largely dependent on foreign aid. Most of the development programmes which the government has launched have received substantial sums of foreign aid, notably from the United States, France, West Germany and the Netherlands, and, despite the rising pressure of Vietcong activity this has enabled the organisation of a number of programmes to improve the economic situation through reconstruction of the transportation and communications infrastructure, the expansion of agricultural and industrial production and at the same time maintain security through the military.

In its overall planning philosophy as laid down in the early Five-Year Plans, the government of Vietnam has laid emphasis on free competition combining public investment with private investment under government guidance. The basic aim was to bring about a steady increase of the country's per capita income level through the continued development of the agricultural economy and the addition of a light industrial base founded on agricultural raw material processing. This was designed to reduce the imbalance in the economy which developed during the French period when the Red River Basin became

the main industrial zone of Indochina. The war has meant, however, that these basic aims have been largely abandoned. Each of the successive government programmes has latterly been designed to solve a specific problem of the moment and each has sought equally to maintain security as well as achieve its stated objective.

Vietnam was faced with such short-term problems very early after its independence with the influx of refugees from the North following the political division of the whole country in 1954.[50] To cope with the vast numbers of refugees, the Commissariat General for Refugees (COMIGAL) was established with the responsibility of finding suitable land for cultivation for the farmers and favourable sites for settlements of both farmers and coastal fishermen.[51] The resettlement programme was in operation by early 1956 with the intention of providing a house and land with all the necessary farm implements, seed, fertilizer and draught animals for each family. Most of the farmer refugees were established in the largely uncultivated parts of the Delta. Where possible those from the same area of origin and of the same religion were relocated together and in the early stages all help was given to help the creation of viable village communities. Food was provided until the community was self-supporting and funds were allocated for housing, land clearance, road and bridge construction and the provision of educational and sanitary facilities.

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50. Smith, Harvey H. et al, "Area Handbook for South Vietnam", 1967, p.141.

51. Bui Van Luong, "The Role of Friendly Nations", in Richard W. Lindholm (ed.), "Viet-Nam, the First Five Year", 1959, p.51.

This type of large-scale comprehensive development programme as designed for the resettlement of refugees from North Vietnam has been tried out in other contexts during the subsequent periods of intensive guerilla warfare. One similar attempt was the so-called Agroville Programme which began in 1959.[52] This was concentrated in the Mekong Delta with the intention of giving the rural population much the same benefits as those in the towns by concentrating them in large communities, which at the same time would give much greater security. By 1961 a number of the isolated hamlets along the banks of canals and waterways had been re-combined into 21 new large villages where modern farming methods were introduced, roads and bridges, ditches and wells were built and repaired and schools and medical stations were expanded. The Agroville programme was controversial and no agrovilles were constructed after 1961. The programme was reorganized and modified as the Strategic Hamlet Programme in March 1962.[53]

More recently the government has sought merely to stabilise the economy through a series of programmes aimed chiefly at pacification in the countryside. The Special Pacification Plan of 1968, for example, was designed chiefly to eliminate the communist infrastructure in the countryside and so give the people the security to carry out their normal occupations. In 1969 the

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52. Republic of Viet-Nam, "7-Years of the Ngo Dinh Diem Administration, 1954-61", 1961, p.65.

53. Smith et al, op.cit., p.231.

Pacification and Reconstruction Plan was instituted with an additional emphasis on democracy in the villages and hamlets, the consolidation of the local administration of the rural economy and the implementation of the villages' self-help programmes.[54] In 1970, the Pacification and Development Plan again stressed community co-operation, with programmes in public works, irrigation, health, education, agriculture, fisheries and animal husbandry being carried out by the people themselves.[55] Yet another programme was initiated in 1971, the "Local Community Self-Defence and Community Self-Development Plan to Build Peace", which once more sought to re-organise local defence, administration and development programmes.[56]

The increasing emphasis in these programmes on community development based on the efforts of the population of the many villages and hamlets testifies to the difficulty the government has had in implementing any unified development strategy in the present unsettled conditions. Most of the programmes, following one another in quick succession as they have, have failed to make any lasting impact and the administration has now turned to laying down the lines of a post-war redevelopment programme for implementation when the so-called cease-fire actually has any meaning. This is to include

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54. Republic of Viet-Nam, "Message of the President of the Republic of Viet-Nam, Nguyen Van Thieu", 1970, p.6.

55. Ibid., p.7.

56. Ibid., p.14.

careful control of inflation and the avoidance of serious deflation, effective programmes for refugee re-settlement and the reconstruction of the whole economic base, particularly agriculture.

Despite its difficulties, it would not be true to say that the development effort of the government of the Republic of Viet-Nam has been entirely unsuccessful. Particularly in the first decade after independence, its efforts to develop industry met with significant if limited success. Smaller businesses were encouraged through government loan under the National Investment Fund set up in 1955,[57] and in 1957 the Industrial Development Centre was established to provide technical and financial assistance to both local and foreign investors to expand and modernize the existing industries and facilitate the establishment of new industry.[58] War damaged industries were rehabilitated and new enterprises established; the textile industry at Binh Dinh was reconstructed and expanded; a paper industry was introduced at Bien Hoa; and the sugar industry was redeveloped in the Tuy Hoa area of central Vietnam. Further investment was concentrated mainly in the glass industry, the rubber industry, which was expanded to manufacture bicycle tyres, sandals and toys; lumber, mainly at Tan Mai, and the cement industry at Ha Tien were also developed.[59] Most of the industrial base continued to

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57. Nguyen Phuc Sa, "A General Report on Industrial Development", in Richard W. Lindholm (ed.), op.cit., p.242.

58. Smith et al, op.cit., p.346.

59. Republic of Viet-Nam, 1961, op.cit., p.245.

be concentrated on the processing of agricultural materials and a survey for industrial minerals was therefore instituted with foreign assistance.

Despite this search for mineral resources, the industrial sector and, indeed, the economy of Vietnam as a whole has continued to depend very much upon agriculture. Although the almost continuous warfare since independence has again prejudiced any effort made by the government to generate agricultural development, a number of problems have been tackled. Through the stabilisation of the agricultural economy the government has felt it will be better to develop the country as a whole and it has sought to expand the cultivated area, diversify crop production, increase yields and improve the government institutes having responsibility for land tenure, credit and taxation.

The Strategy for Agricultural Development

The agricultural base of the Republic of Viet-Nam was badly affected in the Second World War with the abandonment of and damage to large areas of valuable rice-land in the Delta. Much of this was due to the breakdown of the existing irrigation and drainage facilities. Following independence in 1954, a programme was begun to restore about 2.5 million acres (1 million hectares) of the Delta lands for cultivation and also to extend cultivation in the Central Highlands.[60] It

60. Smith et al, op.cit., p.311.

was not anticipated that this would lead to an increase in the rice available for export above the pre-war levels, but it was seen as a necessity for restoring the rural standard of living.

The restoration of abandoned paddy land could not, however, be seen in isolation from the other major problem of land tenure. In the initial period of development of the rice area of the Vietnam Delta, the farms had come to be held by large-scale landlords, often living in the towns, and were worked by tenant farmers who paid high rents and interest rates for their holdings. Any restoration and re-settlement programme thus had to be paralleled by an effort for land reform, bringing about a more equitable distribution of land ownership, helping the tenants to become small land-owners and encouraging the previous landlord element to invest their capital in industrial enterprises. Rice-land abandoned by absentee French and Vietnamese landlords for more than three years was reclaimed and the balance of holdings of over 100 hectares was purchased by the government.[61] These lands were then distributed in plots of about three hectares to small farmers, either to refugees from the north or from the overpopulated areas of the country, or to local landless labourers. The land was usually handed over in six annual installments.

There were four major areas of resettlement, Cai San, the Bac Lieu (Ca Mau) area of the Delta, the

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61. Gittinger, Price, "Agrarian Reform", in Richard W. Lindholm (ed.), op.cit., p.204.

Plaines des Joncs along the border with Cambodia and the Central Highlands. By 1962 this land reform programme of the Diem government completed the distribution of 246,576 hectares to some 115,381 farmers.[62] In 1964 a further period of reform was initiated by Prime Minister Khanh and this was continued in 1965 by Prime Minister Ky. More recently, the Land-to-the-Tiller programme of President Thieu has been instituted and has transferred another 1 million hectares of paddy land to farmers at no cost to themselves;[63] the land titles are, however, only delivered to the farmers when they have paid tax in the village for one year; this helps the government to strengthen its village development programme at the same time. The Land-to-the-Tiller scheme was actually started in 1970; by 1972, about 800,000 farmers had received its benefits.[64]

In addition to attempting to extend the cultivated area and re-organisation of the land tenure pattern in the hope of stimulating production, the government of South Vietnam has sought intensification and diversification of the existing agriculture in much the same way as the authorities in the other riparian countries. Part of the restoration programme of the delta rice lands involved the rehabilitation of the existing irrigation and flood control structures. Modern irrigation

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62. Smith et al, op.cit., p.323.

63. Republic of Viet-Nam, 1970, op.cit., p.11.

64. Prosterman, Roy L., "Land Reform in Vietnam", FOCUS, vol. XXII, no. 5, January 1972, p.7.

had been introduced mainly at Binh Dinh and Phu Yen by the French.[65] After independence these facilities were largely unused and canals and waterways silted up. Restoration required the reconstruction of the dikes, embankment network and barrages in the delta region to protect the area from salt-water intrusion. Dams, sluices and canals were rebuilt, notably the Lao Tam dam at Binh Dinh and the Suoi To dam at Quang Ngai.[66] New hydraulic works were built in the Central Highlands to improve water control and extend the cultivated area. In addition, there were efforts to improve rural water supply through the formation of the Rural Water Supply Task Force in 1964.[67] This helped to drill wells and supplied water pumps to farmers anxious to irrigate their fields for a second crop in the dry season.

Improvement of water supply and control will increase the effectiveness of the other programmes for agricultural development, notably the introduction of all the elements of the Green Revolution, new seeds, chemical fertilizer, insecticide and new farm implements and machinery. All these supplies have been imported for the farmers and research and experimentation has continued to try and assess the best methods of use. Experiments on more than 100 rice strains have continued at the My Tho and Hiep Hoa testing stations. In 1967,

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65. Smith et al, op.cit., p.316.

66. Republic of Viet-Nam, 1961, op.cit., p.321.

67. Nighswonger, William A., "Rural Pacification in Vietnam", 1966, p.175.

the so-called Than Nong or Honda rice was introduced and in 1970 distribution of imported IR-22 seeds was begun throughout the country, with as much emphasis on the crowded areas of Central Vietnam as on the fertile Delta region.[68]

Together with its efforts to develop rice production, the government has also encouraged the planting of secondary crops of high export potential. A variety of crops have been pushed since the time of the Diem administration, including secondary food crops, fruits, vegetables, maize, peanut and soya bean. The Hung Loc experimental station at Long Khanh was established to conduct trials into planting and seed production of a number of crops. More specifically cultivation of red corn was encouraged in An Giang and Kien Giang provinces with the idea of setting up an export trade to Japan. In 1959, the Dalat vegetable and flower station was established for cross-breeding.[69] There has been a programme to improve the varieties and growing practices of sugar cane, to distribute brown and Virginia tobacco to replace poor quality and low-yield native varieties and to expand jute production in An Giang and Vinh Long provinces through the introduction of new varieties developed at the My Thoi jute experiemental station (An Giang). Experimental planting of high-yielding, disease-resistant strains of cotton has been undertaken at Binh Thuan, Ninh Thuan and Phu Yen provinces in the Central Lowlands. For tree crops, there has been a

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68. Tran Quang Minh, "Agricultural Development in Viet-Nam", The Vietnam Council on Foreign Relations, 1970, pp. 9-11.

69. Republic of Viet-Nam, 1961, op.cit., p.328.

programme begun in 1960 to expand the area under lacquer trees in the Central Highlands, following research at the Di Ling and Dai Bing stations in Lam Dong province and efforts have also been made to assist rubber small-holders in improved cultivation techniques and adoption of new stock.

To support more efficient agriculture, the import of chemical fertilizer into Vietnam has increased, fertilizer mixing plants have been established and a plant for the manufacture of urea was planned for 1970.[70] This has been held up for lack of loan guarantee.[71] A farm machinery plant at Bien Hoa can manufacture new farm and fishing implements.

The adoption of these new inputs requires more capital investment on the part of the farmer and the Vietnamese government has sought to help the cultivators by the development of a larger credit programme. The Agricultural Development Bank is expanding its operations and private individuals have been encouraged to set up private rural banks throughout the country specialising in credit for agricultural enterprises. The National Agricultural Credit Office was established in 1957 to grant loans to individual farmers and also to co-operatives and in 1959 the foundation of the Commissariat for Co-operation and Agricultural Credit was designed to co-ordinate these various programmes and provide a general strategy for farm credit; this was abolished in

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70. Republic of Viet-Nam, 1970, op.cit., p.11.

71. Far Eastern Economic Review, vol. 84, No. 18, May 1974, p.67.

1965.[72]

To remedy the shortage of trained personnel to carry out the various programmes of agricultural development, a National College of Agriculture was set up at Bao Lac in Quang Duc province in 1955 to train farmers in modern methods of farming. Agricultural extension services have now been established in all provinces and training centres have been founded; Farmers' Associations and Rural Youth Groups (4-T Clubs) have been organised with the idea of easier communication of new techniques to the farmers.[73]

The work of these extension services extends equally to other sectors of the rural economy, livestock husbandry, fishing and forestry. The government has been trying to upgrade the quality of the Vietnamese diet by stimulation of the production of pigs, fish and poultry; moreover a scheme to produce pigs and ducks for export was initiated in 1959.[74] These projects necessitate improvements in quality and better breeding stock and large-scale breeding stations have been set up at Hung Loc (Long Khanh), Nha To (Ninh Thuan), Khanh Hoa) and Ben Cat (Binh Duong). In 1969 Duroc and Poland-China pigs were imported for the basic breeding stock at the pure-bred swine demonstration farms; there is an extensive programme to eradicate rinderpest and pig cholera, covering many provinces and an animal investigation and control laboratory has been set up at Chanh

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72. Smith et al, op.cit., pp. 332-33.

73. Ibid., pp. 334-335.

74. Republic of Viet-Nam, 1961, op.cit., p.328.

Hung (Saigon) to guard against imported epidemic diseases. The so-called pig-corn programme has sought to improve feeding by supplying corn and capital to pig farmers, but in 1969 a sorghum project was launched to decrease dependence on imported corn. In seeking to develop a commercial poultry industry, improved breeds, modern equipment and new poultry farming techniques have been introduced and the Institute of Bacteriology founded in 1955 has increased the production of protective vaccines for animal disease control.[75]

Most of the government's attention in fishery development has been focused on commercial sea fisheries, where assistance has been given to groups of fishermen to purchase new equipment, new boats and engines to increase the numbers of motorised boats. A research institute was set up in 1969 and cold storage facilities have been developed at Saigon and Nha Trang.[76]

The principal aim in forestry development is to control and regulate logging to increase exploitation for lumber and paper manufacture. Shifting cultivation in the Central Highlands is being carefully controlled when conditions will permit and there have been re-afforestation programmes in Dalat and Pleiku provinces. Exploitation of pine and bamboo forests has begun for the paper and pulp industries and experimental stations have been established at Cau Hai, Lang Co and Thuan My

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75. Ibid., p.332.

76. Ibid., p.253.

for water palms and at Pleiku for peppermint.[77] Much of the fighting has of course taken place in the forested regions and great destruction has taken place. Given conditions of peace, this will be one of the most urgent programmes for the Vietnam government.

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77. Ibid., p.337.

CHAPTER VII

INTERNATIONAL DEVELOPMENT AND CO-ORDINATION

As was noted above, the great resource potential of the River Mekong has to date remained untapped. Indeed the 'sleeping giant' has been more a destructive than a beneficial influence on the way of life of the surrounding population. The large magnitude of fluctuations in water levels has meant that, in years of heavy rainfall, there has been considerable crop loss through flooding in the rainy season; on the other hand, in drier years there is the danger of salinity intrusion in the delta area. The low dry season flow, along with the presence of formidable rapids in its middle course, has also restricted the possibilities of using the Mekong as a navigable waterway for more than short distances along its length.

In the search for improving the productivity of their agricultural economies and in order to keep pace with rapidly rising populations and to provide a more diversified export base, the riparian countries of Thailand, Laos, the Khmer Republic and the Republic of South Viet-Nam have long recognised the potential of the Mekong River for development and the need to control its disastrous floods. It was not until the emergence of the three latter territories as independent states, however, that any concrete proposals were put forward to harness the Mekong.

In fact, the first international co-operation in the use of the River Mekong began as early as 1926, but these early agreements covered only the field of

navigation. In 1926, France and Thailand concluded an agreement on freedom of navigation on the river; in 1949, Cambodia, France, Laos and the Republic of Viet-Nam agreed to sign a Convention of Maritime and Inland Navigation, but this was never activated.[1] Later, in 1954, Laos, Cambodia and Vietnam agreed to co-ordinate programmes on navigation, river improvement and other projects which might affect navigation, but this was scarcely international co-operation in that it affected only the three ex-colonial territories of French Indochina.

The true potentials of the river, till then, were very little studied and even less understood. The first real international co-operation in the overall development of the Mekong Basin followed the establishment of the Economic Commission for Asia and the Far East in 1947, when there were arranged a series of conferences on water problems, water resources planning and basin development. The Bureau of Flood Control was established as a subordinate organisation of ECAFE in 1949 to advise and assist governments in dealing with flood control and related river problems.[2] In 1951, the Bureau started a programme to study technical problems involved in the development of international rivers and a study of the Lower Mekong was suggested. With the agreement of the four riparian governments, a comprehensive development

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1. Schaaf, C. Hart and Fifield, Russell H., "The Lower Mekong: Challenge to Cooperation in Southeast Asia", 1963, p.82.

2. Ibid., p.83.

project for the Mekong Basin was drawn up. Many of the Basin's resources had not been explored and before 1954 the local political conditions made it impossible to do any field-work in many parts of the Basin, but after the Geneva Accords in July 1954, many projects were set in motion to remedy the situation. In 1955, a plan of development was put forward and the first field reconnaissance of the area began with the assistance of the United States Bureau of Reclamation. In 1956, with the co-operation of the governments of the four riparian countries, further field studies were commenced throughout the Basin by ECAFE and the report 'Development of Water Resources in the Lower Mekong Basin' was produced. By the time the Mekong Development Plan was officially drawn up at the ECAFE meeting in March 1957, many developed countries had promised to co-operate for the future development of the project. The four riparian countries determined to continue the studies made to ascertain the potentials of the river's water supply in more detail and agreed to set up the Co-ordination Committee composed of the representatives of each country under the auspices of the United Nations as represented by ECAFE.

In October 1957, the Committee for the Co-ordination of Investigation of the Lower Mekong Basin (the Mekong Committee) was officially set up and a five-year plan of reconnaissance of the whole Basin area was recommended by the Wheeler Mission Report[3] as the basic

3. Report of United Nations Survey Mission under Lieutenant General Raymond A. Wheeler, "Program of Studies and Investigations for Comprehensive Development of the Lower Mekong Basin", 1958.

policy for the commencement of the development of the Basin. With the co-operation of a number of countries a large part of the proposals of this survey plan have been completed. These included the field investigation of the main tributaries, the establishment and the operation of a hydrological observatory network, and the survey and mapping of the river and potential arable lands at each dam site, where geological surveys were also carried out.

The Second Five-Year Plan of the Committee (1964-68) began at its Twentieth meeting and was concerned with both further research and with preliminary construction. Construction was centred on a number of small tributary projects, notably the Nam Pung electricity project for pump irrigation and the Nam Rong irrigation project, both in Northeast Thailand, whereas work on the main stream was still mainly on research and feasibility studies. Although the tributary projects have progressed further than the main stream developments, in the long term it is the Mekong River itself which remains the key to the systematic economic development of the Basin. In the case of power production alone, tributary projects will be able to contribute only a small proportion of the future electric power needs of the region and it has been calculated that the utilisation of the Mekong mainstream power will be much cheaper than power derived from the tributary schemes. Moreover it is believed that both the volume and the cost of water for irrigation and the economics of flood control show advantages in mainstream project implementation, to say nothing of the

benefits of navigation improvement.[4]

Thus it has been the work of the Mekong Committee, which now has the overall responsibility for the project as a whole, to put such schemes of enormous potential into practice. Most of the possible projects being examined are multi-purpose developments, but all fit into the basic objective of controlling flood and providing water storage and electric power for the Basin. The overall concept is to equalise the fluctuating wet and dry season flows of the Mekong as far as is physically and economically possible by a system of reservoirs on the main river and many of its tributaries with ancillary control structures in the delta. The store of excess flow would greatly reduce flooding and would provide water for the development of irrigated agriculture and extensive riverine and on-farm fisheries. The projects suggested may broadly be classified into the fundamental mainstream structures on which final planning decisions have not been made and tributary projects some of which have already gone ahead.

The Mainstream Projects

As White has suggested,

> "There is no one simple program for harnessing the Mekong in the public interest, there are many possible variations each with its advantages and disadvantages. Careful analysis based upon adequate data must be made if the varying elements in the river program are to be weighed and combined in proper relation to each other and to the economic and administrative capacities of the four countries".[5]

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4. UN/ECAFE/Mekong Committee, "Annual Report", 1972, p.26.

5. White, Gilbert F., "Economic and Social Aspects of Lower Mekong Development", 1962, p.1.

Thus integrated studies of the potential of the proposed dams on the mainstream system with respect to irrigation, hydro-electric power generation, flood control, navigation improvement and across the dam roadways have been set in motion and there have now advanced to various stages. In the Report of the ECAFE expert group reconnaissance survey in 1956,[6] five mainstream projects, Pa Mong, Khemerat, Khone Falls, Sambor and Tonle Sap, were identified and further investigations, mainly in the form of basic data collection were started. The emphasis of this work has been on the physical and engineering problems involved in each of the sites.

Since the initial reconnaissance, a number of other studies has brought the number of possible mainstream projects which have been under investigation to seventeen, including alternative sites for the same basic structure. Because of the paucity of general information about the areas involved most of these projects are in a very preliminary phase. Basically three types of schemes have been put forward: the first group, which includes such schemes as Pa Mong, Stung Treng, High Pak Beng and High Luang Prabang, involve the construction of a dam and storage reservoir with associated hydro-electricpower generating facilities; the second group are barrage schemes such as Sambor in which irrigation facilities are provided by diversion weirs and hydro-electricity by run

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6. ECAFE Export Group Reconnaissance Survey preliminary report, "Development of Water Resources in the Lower Mekong Basin" later published as the UN Flood Control Series, No. 12.

of the river generation; the third group includes only the peculiar designs involved in the Tonle Sap and Delta projects. Table VII.1 shows summary characteristics of each of the schemes proposed and Figure VII.1 their general location. Of all these possible projects, the Mekong Committee has assigned high priority to three of the original five sites, Pa Mong, Sambor and Tonle Sap. The preliminary feasibility studies of Pa Mong and Sambor have already been completed.

The Pa Mong project, seen as the most important in the overall development of the Lower Mekong Basin, is a multi-purpose water use and control project with irrigation and power generation as the most important functions. The Pa Mong dam and tributary dams on the Nam Lik in Laos and the Nam Mong in Thailand could also provide significant control of the river, the reservoir storing flood flow and partly alleviating the extensive floods that occur downstream. The Pa Mong scheme will command an extensive irrigable area in both Laos and Northeast Thailand comprising some 43,000 hectares in the first stage and as much as 1.6 million hectares when completely integrated with other projects nearby.[7] It is designed for a power generation capacity of about 4800 MW. The upstream position of Pa Mong and its vast storage capacity should enhance the viability of all the projects downstream. The power production capacity of all downstream projects will be improved by the greater regularity of flow provided, downstream navigation will

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7. UN/ECAFE/Mekong Committee, "Report on Indicative Basin Plan" 1970, p.V-20.

TABLE VII.1

POSSIBLE MAINSTREAM PROJECTS OF THE MEKONG RIVER

Project	Storage capacity (million m^3)	Power Installed capacity (MW)	Irrigation Total area (000 ha.)	Flood Control Agri. land protected (000ha.)	Navigation a/ (m^3/sec)
Large Storage Dam Projects					
High Pak Beng	25,900	1,850	-	-	1,391
High Luang Prabang	9,862	1,500	- b/	-	656
Pa Mong	76,868	4,800	1,600	148	2,085
Stung Treng	46,500	3,400	1,287	4,950	3,680
Run-of-River Projects					
Low Pak Beng	200	350	-	-	-
Low Luang Prabang	140	350	-	-	-
Sayaboury	30	240	-	-	-
Bung Kan	2,000	220	-	-	-
Upper Thakhek	3,400	400	-	-	400
Lower Thakhek	1,800	250	-	-	250
Khemarat	152	420	-	-	-
Ban Koum	1,400	900	-	-	255
Pakse	200	350	-	-	-
Khone Falls	560	750	200	-	216
Sambor	2,050	875	34	-	525

a/ Increased in minimum monthly flow. b/ Integrated with all other projects

Source: Report on Indicative Basin Plan, Mekong Committee, 1970.

be improved and salt-water intrusion in the delta will be reduced. The storage of flood water will eliminate overbank flow in the river valley from Pa Mong to the Nam Mun confluence and will also reduce flooding in the delta.

Field investigations of the Pa Mong project have been completed in at least two respects. First an investigation into power production was carried out, involving also a study of transmission line capacity. This was followed by a study, completed in 1971, into the irrigation potential of the project. This collected data on the arability, irrigability and agricultural potential of the Northeast of Thailand and the Vientiane Plain in Laos and into possibilities of trans-basin diversion of water from Pa Mong to the Chao Phaya basin.

Studies are moreover continuing so that the Pa Mong project will make a maximum contribution to the well-being of the people of the Lower Mekong Basin. The governments of Thailand and Laos are carrying out specific research and providing socio-economic information on agricultural economic patterns in the area, including details on productivity levels, crop yields, fertiliser use, crop management practices, animal husbandry and the use of marginal land. In addition studies are being conducted into the possible benefits to be gained from flood control, navigation and fisheries, provision of domestic, municipal and industrial water supply and of power facilities. At present there are also investigations into the resettlement of families displaced by the reservoir, on-farm fisheries, the detailed geology

of the dam-site and the loss of archaeological remains, as well as further study of the downstream benefits, particularly the value of low-flow augmentation for dry season irrigation in the delta in Vietnam.

Apart from Pa Mong, Sambor and Tonle Sap are the other priority mainstream projects for which feasibility studies have already started. That for Sambor was completed in 1969.[8] This is a proposed run-of-the-river project with only limited storage capacity which will be able to irrigate an area of about 34,000 hectares on both sides of the river downstream of the dam site and improve navigation for about 50 miles upstream.[9] Reservoir storage would enhance the power generation capability of Sambor, providing electricity which could be used for pump irrigation, water supply and drainage to the north of the Tonle Sap. The economic feasibility of this would be dependent on Vietnam's capability of utilising power from Sambor and the size of its electro-processing industry, although a World Bank Report has suggested that increased storage capacity

> "..... would significantly enhance the power capability of Sambor and that the project would be economically justified even without taking into account the benefit of upstream storage and without establishing an aluminium smelting industry, provided both the Khmer Republic and Viet-Nam were to use it as the source for their electric power requirements from 1983 onwards". 10

The studies and anlaysis of Sambor's role in the mainstream developments is continuing.

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8. Sambor feasibility report prepared by the Overseas Technical Cooperation Agency (OTCA) of Japan.

9. Schaaf and Fifield, op.cit., p.106.

10. UN/ECAFE/Mekong Committee, 1972, op.cit., p.33.

The Tonle Sap - Delta Project is of a rather different type. The characteristic reversal of flow, whereby water from the Mekong flows into the Great Lake in the flood season and the subsequent draining of the Lake by the Tonle Sap river in the dry season, was described above. This feature causes a number of problems, erratic yields for the fishing industry, annual flooding in the delta, poor drainage in a large area of the Khmer Republic and the Plain des Joncs in Vietnam, navigational difficulties between Phnom Penh and the South China Sea in the dry season and the intrusion of saline water into the delta could all be improved by proper regulation of the flows in and out of the Great Lake.

The study of the Tonle Sap project by the Mekong Committee began in 1961,[11] involving studies of the benefits of construction of barrage gates across the Tonle Sap river at Kompong Chhnang between the Great Lake and Phnom Penh to control the Mekong flow during the period of highest water to cut off the peak flood and to increase the river depth in the low water season. The water stored in the Great Lake could provide considerable dry season irrigation for agricultural development in the Khmer Republic below Phnom Penh and in the Republic of Viet-Nam, enrich the Great Lake fisheries and improve deltaic fishing. During the low-flow period, it could provide adequate flow to facilitate navigation to Phnom Penh, diminish the intrusion of salt water and improve drainage in the Delta. Consideration of the

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11. Feasibility report prepared by the Central Water and Power Commission (CWPC) of India.

Tonle Sap project continues, but additional information on flood damage and fisheries in the area is being held up by the poor security situation.

The Delta Development is another plan related to the Tonle Sap project, currently being supported by the Netherlands government. An analysis of the role of the silt load in contributing to the fertility of the delta and the likely affects of upstream storage, diking in the delta and other flood control measures has begun; a study of the management of heavy clay delta soils to determine the best means of crop diversification is under way; and research on salinity intrusion at the mouths and in the canals of the Mekong should provide the information needed for the design of control structures and facilities for fresh water supply to irrigated areas in the salt-water intrusion zone.[12] The government of South Vietnam has also taken responsibility for providing hydrological data essential to further planning, but the troubled conditions which prevailed throughout 1972 in the area have complicated all field-work for this project.

Preliminary layouts for the other mainstream projects were initiated in 1971. Since the investigation of all sites requires a great deal of money, planning has so far been limited to site mapping and survey. At present the Stung Treng project in Laos and Cambodia

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12. UN/ECAFE/Mekong Committee, 1972, op.cit., p.35.

has the highest priority for comprehensive investigation, but data cannot be obtained because of the poor security conditions at the dam and reservoir sites and in the proposed service areas. Detailed feasibility investigations will be essential for any future programmes. A review of the Upper Thakhek project was completed in 1972 and the study of this, the Ban Koum project and their alternative sites are continuing as the other main areas of current investigation.

The Tributary Projects

The work of the Mekong Committee in the development of water resources is not only concerned with planning the use of the waters of the River Mekong itself, but also with the many tributaries which join it from the highlands of northern Laos, from the Annamite Chain, from the Khorat Plateau and from the Tonle Sap basin. Although the poor security situation and the heavy cost of development has to date prevented the final implementation of any of the mainstream projects, a number of tributary schemes, which also have the advantage of being located within the territory of a single riparian country, have been constructed. Although these are much smaller than the proposed mainstream developments, they are still quite important; since their construction requires less financial outlay and takes up less time, it is hoped that their prior development will allow study which will later be relevant to the progress on the main stream. According to a study made by a Japanese consultant team in 1961 under the auspices of

the Mekong Committee, some 87 possible tributary projects have been recognised throughout the whole Lower Mekong Basin, 28 in Laos, 15 in Cambodia, 16 in Thailand and 28 in the Republic of Viet-Nam. Of these, twelve projects have already been completed and three others are currently under construction. (Figure VII.1).

The current planning schedule of the Mekong Committee is divided into two periods, a short-range period from 1971 to 1980 which mainly concerns the development of independent tributary projects and a long-range plan (1981-2000), involving largely mainstream projects which are interdependent with one another.[13] The tributary projects will only be able to meet the increasing demand for irrigation, flood control and electricity for only the first part of the next thirty years; after 1980 the mainstream projects will be necessary, but the tributary projects will still continue to meet local demands and supplement the integrated mainstream systems.

It has been estimated that between 1971 and 1980 there will be an additional need for irrigated land in the Lower Mekong Basin, amounting to 62.5 thousand hectares in the Khmer Republic, 15 thousand hectares in Laos, 144 thousand hectares in Thailand and 65.5 thousand hectares in Vietnam. The future demand for electric power in the riparian countries will reach a peak of 97 MW in the Khmer Republic, 51 MW in Laos, 2376 MW in Thailand and 1232 MW in South Vietnam.[14] According to

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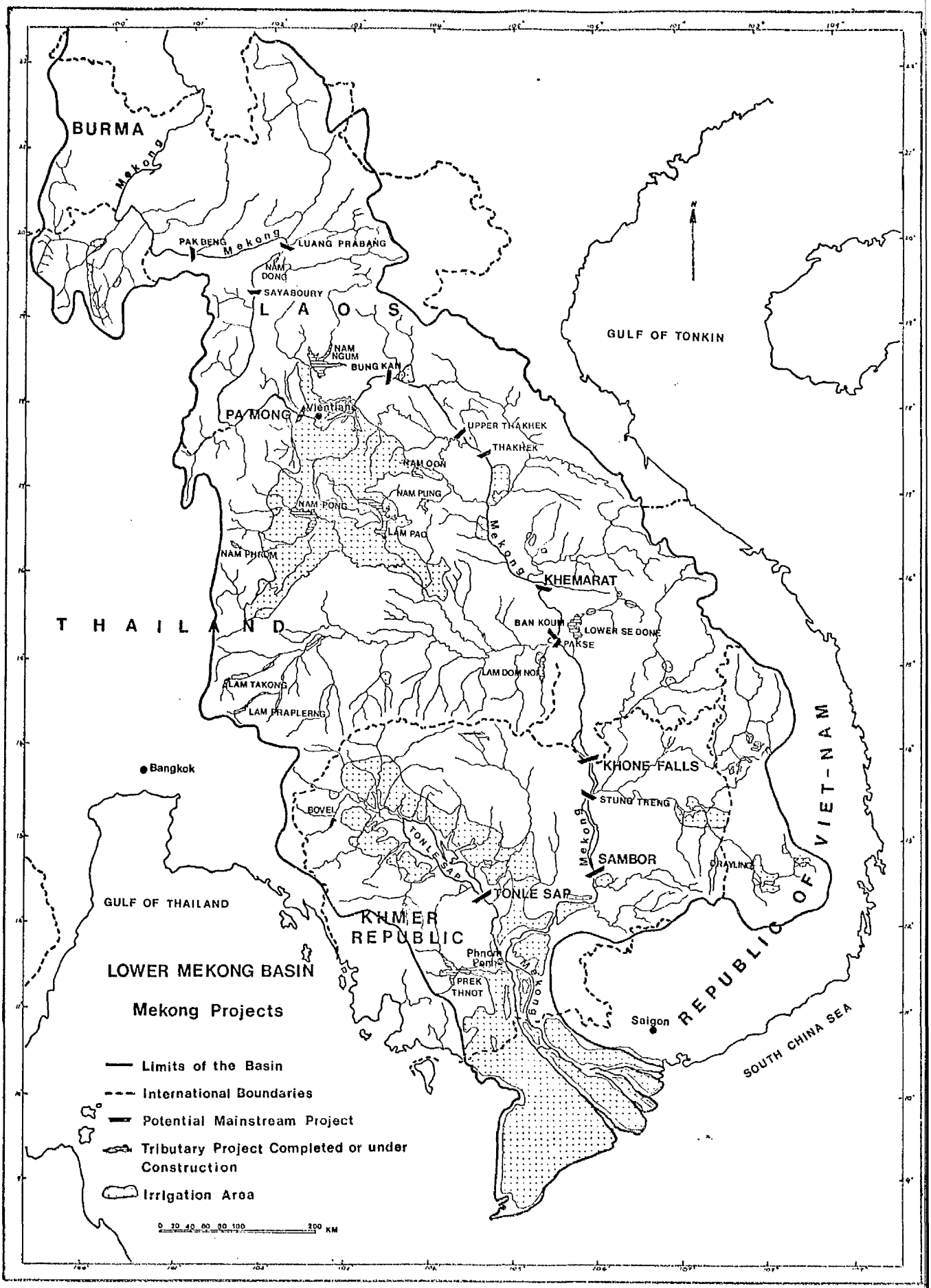
13. UN/ECAFE/Mekong Committee, 1970, op.cit., p.V-3.

14. Ibid., p. V-61.

Figure VII.1: Location of Possible Mainstream Projects and Completed Tributary Projects, Lower Mekong Basin, as of 1972



Source: Report on Indicative Basin Plan, Mekong Committee, 1970

recent studies of the tributary projects, the Prek Thnot scheme, now under construction, and the Battambang project will be able to provide the total irrigation and power requirements in the Khmer Republic up to 1980, while in Laos, the Lower Se Done, Nam Ngum and Nam Dong projects, which are all already completed, will be sufficient. In Thailand seven tributary projects have been completed. Of these, the power generated at Nam Pong, Nam Pung, Lam Dom Noi, Nam Phrom and Pak Mun could provide sufficient power generating capacity for the needs of the Northeast, but such tributary projects will not be able to meet the power demands of Central and Northern Thailand. The additional power will be provided by importing from Nam Ngum or by integration with thermal and hydro-electric plants in the other regions. As in the other three countries, in Vietnam additional irrigation and power requirements up to 1980 can be served from Upper Se San and Upper Sre Pok.

Most of the tributary projects mentioned consist of a dam, reservoir and power plant. Irrigation and power production are the main objectives of most of the schemes, although in some cases they have a flood control component. The tributary projects can irrigate large areas of land which will not be able to be served from the mainstream and though the cost of producing power from them may be higher than from the mainstream projects, they will be able to meet the limited local needs without large expenditure.

Of the twelve tributary projects that are now in operation, one is in the Khmer Republic, three are in Laos, another in the Republic of Viet-Nam and the

rest in Northeast Thailand. In addition, Prek Thnot and Nam Oon in Cambodia and Thailand respectively are under construction. The investigation of other possible sites remains at a very preliminary stage.

In the Khmer Republic, the first project, the Bovel irrigation weir, which was completed in 1968, will be able to irrigate an area of about 30,000 ha. in its first stage. In the second stage the irrigated area will be extended to 45,000 hectares with the construction of further irrigation canals and drainage facilities.[15] Prek Thnot is a multi-purpose project, currently under construction, involving a diversion weir and a first stage irrigation project with a main dam and power facilities. It will provide 2MW of energy for consumption in Phnom Penh and irrigation to 5,000 ha. in the first stage.[16] The project was delayed by an attack in 1971, but the first stage was recently completed. Security problems have also retarded the progress of the feasibility studies on the Battambang and Stung Chinit projects. It has been estimated that the 15 projects in the Khmer Republic could eventually produce 319MW of firm power and irrigate an area of 576,000 hectares.[17]

The three projects already completed in Laos are the Lower Se Done, Nam Dong and Nam Ngum projects. The

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15. The Khmer government statistics as quoted in UN/ECAFE/Mekong Committee, 1972, op.cit., p.42.

16. UN/ECAFE/Mekong Committee, 1970, op.cit., p. V-44.

17. Ibid., p. V-43.

dams and power stations of Lower Se Done and Nam Dong have been in operation since 1970 and 1971 with an installed capacity of about 2.5 and 1.25 MW respectively. Nam Ngum is another dam and power station project which was inaugurated in December 1971.[18] Laos is now transmitting electricity from this dam to Northeast Thailand in return for the cement which Thailand provided for the construction of Nam Ngum and for the electric power she supplied for Vientiane and Nam Ngum during the construction phase. Additional studies in phase II include expanding project operation and evaluating flood control benefits downstream. In Laos reconnaissance is also going ahead on Nam Theun, although there were serious interruptions because of fighting in 1972.

In Thailand, Nam Pung was the first project completed in 1965 to provide electric power which is partly used for pump irrigation in Sakon Nakhon province. The Nam Pong scheme, operational since 1966 has a larger power generation capacity from the Ubolratana dam and this project can send water from the Nam Pong river via the Nongwai diversion weir to an irrigated area of 53,000 hectares.[19] Like the even larger Lam Pao project, which began to transmit water in 1969, Nam Pong has yet to serve the whole of the potentially irrigable area. Unlike Nam Pong, Lam Pao contains no hydroelectric component.

Four other schemes have recently been completed. Lam Takong, finished in 1970, and Lam Pra Plerng and Lam Dom Noi, completed in 1971, together will irrigate

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18. UN/ECAFE/Mekong Committee, 1972, op.cit., p.43.

19. Ibid., pp. 45-46.

some 82,000 hectares in the wet season and over 50,000 hectares in the dry season when the latter's irrigation works become generational. The Lam Takong scheme will also provide flood control and water supply for Nakhon Ratchasima city. Lam Dom Noi is also a hydro-electricity project and along with the Nam Phrom scheme, completed in 1972 purely for power generation, it will add some 76,000 KW to the regional capacity. An eighth scheme, the Nam Oon Dam, is still under construction; this is mainly an irrigation scheme, but fishery development is also planned.

All these schemes are in the Northeast region. In the north, in Chiang Rai province, a feasibility study is under way on the Nam Mae Kok and reconnaissance studies of ground and surface water resources have been completed on the Nam Mae Lao and the Nam Mae Ing. In the Northeast, further feasibility studies are in progress on Nam Mun, Nam Chi and Pak Mun.

The Drayling project is the only one completed at present in the Republic of Viet-Nam. The Mekong Committee assisted by providing a fund for the extension of the existing power station which has an installed capacity of about 580 KW. After feasibility investigations of irrigation schemes in the Upper Se San basin, a run-of-the-river project on the Yali Falls on the Se San and a reconnaissance study of the Upper Sre Pok were completed, but no further work has been undertaken because of the unstable situation in that area.

Agricultural Development Programmes of the Mekong Committee

The control and utilisation of the water resources of the Lower Mekong Basin as outlined in the tributary and proposed mainstream projects described above should bring great benefit to agricultural development in the region. It will enable annual farm activities to be stabilised and so generate an expansion in the agricultural processing industry. Through the use of improved technology and cultivation methods, rice yields should be able to be doubled and tripled; the area of double-cropping should be increased and further crop diversification made possible. This increased and diversified agricultural production will in turn raise the rural living standards for the whole of the Basin.

The work of the Mekong Committee is, however, not merely involved in the construction of the physical facilities for water control and management. The agency has recognised the need for research and experimentation into the best and most efficient methods of making use of the new facilities. This extends not only to the fields of agriculture and livestock-rearing, but also to the management of forestry and fishery resources. Canals and irrigation water alone cannot modernise farming in the Basin and already a number of programmes have been developed to assist in the process of modernisation. To date, activities have been limited to pre-investment programmes including general technical socio-economic research, demonstration and pioneer projects and other schemes related to water resource development.

The Committee has sponsored the establishment of experimental and demonstration farms in each of the four riparian countries with the aim of developing basic information for water management, for diversifying and increasing crop production in order to obtain the highest possible return from investment in water resource development. Extension services have been developed through the institution of regular training programmes in agriculture and support has been given to the study of credit and co-operative development, land reform and land tenure problems. In the field of fisheries, study and planning on the possibility of increasing fresh-water fish production in reservoirs resulting from dam construction has been carried out and studies in forestry improvement have included research on the possibility of commercial plantations for pulp and paper manufacture. In livestock development work has been done on the growth response of grasses to irrigation and fertiliser and on the carrying capacity of pasture. Most of these programmes are co-ordinated with similar work being carried out by the national governments, but the emphasis of the Mekong Committee's work has been on the role of water resource development in these contexts.

The Experimental and Demonstration Farms

As the Mekong Committee themselves note,

> "The irrigated experimental and demonstration farms in future irrigation project areas are a central component in the Committee's program" 20

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20. UN/ECAFE/Mekong Committee, "Annual Report", 1968, p.77.

Study and research on these farms will give the comparative basic data that is necessary for future irrigation project planning. Experiments at the farms have largely related to examination of the relative productivity of various crops and crop strains, of the fertility of lowland paddy soils and of the response to chemical fertiliser application of both paddy and dry season crops.

There are five experimental stations for irrigated agriculture now in operation in the Basin under the auspices of the Mekong Committee (Figure VII.2) and two new establishments are also scheduled to be set up in the Khmer Republic at Tual Samrong (Battambang) and Prek Leap (Phnom Penh).[21]

At present the Khmer Republic already has two experimental farms, one at Banan and the second at Prek Thnot. The latter scheme began in 1965 with the intention of developing new cropping patterns in the Prek Thnot tributary irrigation project. Here experiments were mainly concerned with the breeding of high-yielding varieties of rice and the improvement of weed control and other farming practices. Tests on the comparative fibre and seed production of various varieties of kenaf have been carried out with the aim of increasing the production of kenaf bags, canvas and threads in the Khmer Republic. Cultivation of vegetables for the Phnom Penh market has already been a major success. Large-

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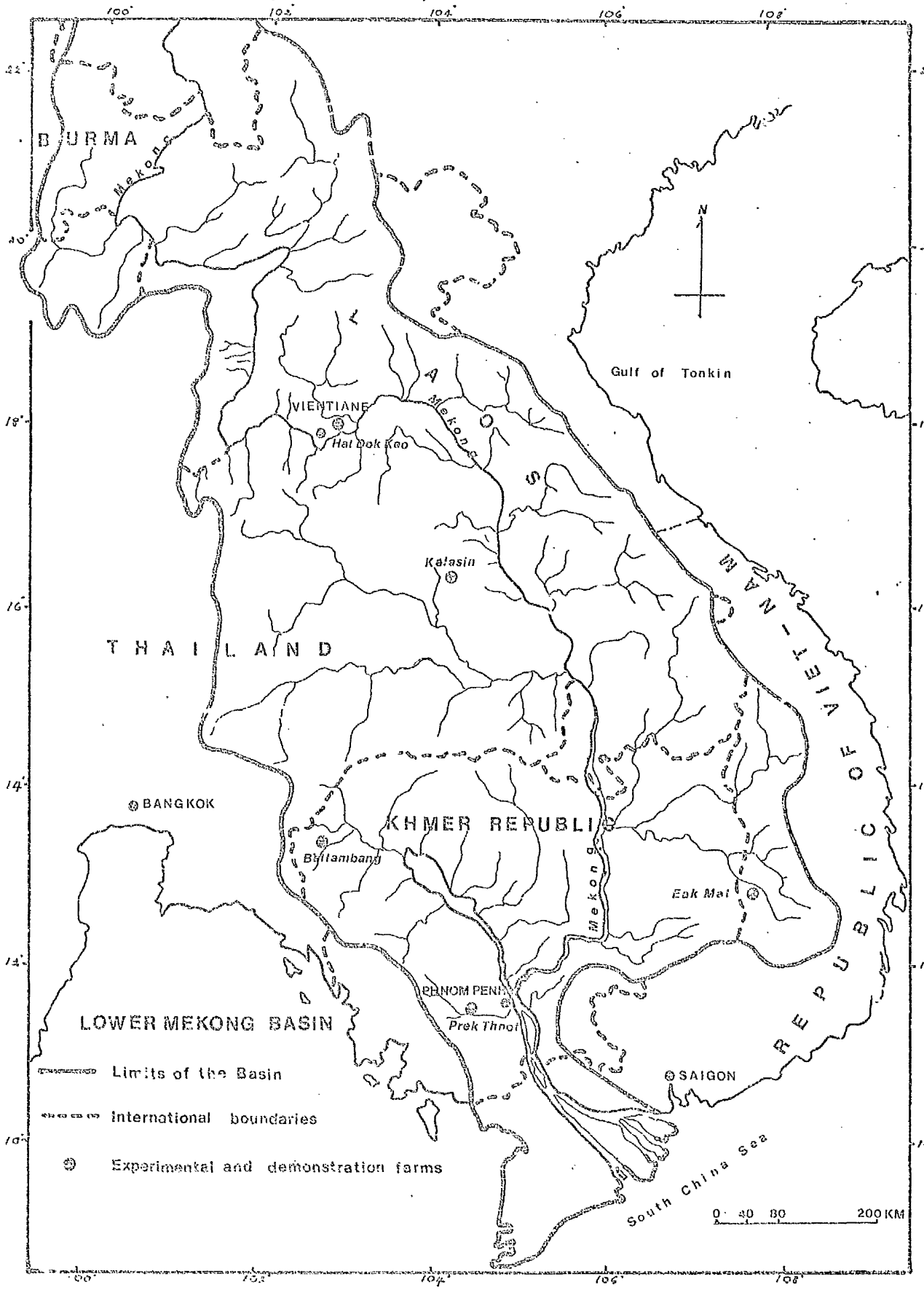
21. UN/ECAFE/Mekong Committee, 1972, op.cit., p.73.

Figure VII.2: Location of Experimental and Demonstration Farms under Mekong Committee Sponsership (as of 1972)



Source: Report on Indicative Basin Plan, Mekong Committee, 1970

scale crop trials in the demonstration zone of the farm were concerned largely with variety tests, fertiliser application rates and pesticide treatments for rice, groundnuts, sorghum and vegetables. The Banan farm, which began operations in 1966 is experimenting with rain-fed cropping in the wet season. Large-scale trials have concentrated on rotation patterns and seed multiplication, the study of imported and local varieties of rice and tests on fertilisation and varieties of cotton, kenaf and jute. Experimentation on dry season irrigated cropping began when the construction of the irrigation facilities was completed in 1971.

The Kalasin demonstration farm (Huey Sithon) in Thailand which dates from 1965 is important for the work on the improvement of irrigated lowland soil characteristics in the Mun-Chi Basin. Since soil conditions in the area are very complex, more work is required to determine future cropping possibilities and cultivation methods on different types of land. By 1973 about 90 percent of the irrigation canals and 58 percent of the drainage system in the demonstration farm area had been completed on this project,[22] but work has already been going on into increasing yields of new varieties of rice, fibre crops and oil seeds, notably soya bean and groundnuts. The tests on soya bean have been designed to identify the best date for planting in both the dry and rainy seasons; sorghum experiments have given good results on the farm. Efforts have also been made to improve the quality of the livestock, particularly cattle, in the demonstration area.

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22. Ibid., p.72.

The Hat Dok Keo farm in Laos was established in 1962 over an area of about 5000 hectares in the Nam Ngum and Vientiane Plain irrigation projects.[23] Experiments here have centred on comparing local and imported varieties of rice, on the development of market garden crops in the wet season and on the production of hybrid varieties of maize to get higher yields in the dry season. Studies are also in progress on livestock (pigs) and on the different types of animal foodstuff which may be processed from the agricultural products of the farm.

The Eak Mat farm is the first experimental farm in the Republic of Viet-Nam beginning operation only in 1972. The construction of the irrigation system which includes a pumping station and main canal system in part of the Upper Sre Pok basin began only in 1971 and experimental programmes on irrigated crops only got underway in mid-1972.

The Pioneer Agricultural Project Programme

The work of the experimental and demonstration farms forms the scientific branch of the work of the Mekong Committee in agricultural development. Here, however, work is often being carried out under ideal or near-ideal conditions and under close supervision by the extension staff. To project the results of the research and experimental work to the farmers under field conditions, the second component of the Mekong Committee's work for agricultural development is the pioneer project.

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23. UN/ECAFE/Mekong Committee, 1968, op.cit., p.79.

> "Pioneer agricultural projects are considered to represent an indispensable stage between the experimental and demonstration farms of the Committee and modernization of agriculture throughout the Basin" 24

They are designed to help develop the necessary organisational base for agricultural development. It covers an area large enough to allow detailed studies of the economic and social organisation of the village communities, of such problems as rural credit requirements, marketing facilities and institutional development and of the overall organisation of the irrigation supply system. The various projects already begun within the Basin do differ in emphasis, but all form an intermediate step between the experimental farm and the basin-wide development of agriculture.

In the Khmer Republic, the second phase of the Prek Thnot project is to incorporate a major pioneer project. This is to involve studies of land consolidation, land levelling, and construction of the minor irrigation and drainage works. Already in this area demonstration of fertiliser usage in conjunction with dry season cropping has led to a marked increase in fertiliser consumption in the project area and an associated marked increase in yields. Other pioneer schemes are planned for the Phnom Penh area and the Bovel development; in the former pump irrigation is being developed.

The agricultural development programme for Laos is centred on the Vientiane Plain, where pilot projects include feasibility studies of the Mak Neo sector of

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24. UN/ECAFE/Mekong Committee, "Annual Report", 1971, p.86.

the plain, the construction of the Tha Ngon project and the Casier Sud irrigation and flood control scheme. The Northeast of Thailand, however, has received the greatest impetus for pioneer project development. Here there are schemes for a pumping station on the right bank of the Mekong, tank irrigation and rain-fed crop improvement. Investment has also been made in the major tributary projects with pioneer projects for crop diversification, notably at Nam Pong under the auspices of the Asian Development Bank, and a series of socio-economic studies at Nam Pong, Lam Pao, Tha Bo (pump irrigation), Lam Dom Noi and Lam Pra Plerng. Plans for the development of livestock farming with rain-fed agriculture at Manchakiri have also been designed.

In the delta of the Mekong in Vietnam and the Khmer Republic, studies on the possibilities of flood regulation, diking, drainage and irrigation are being carried out in order to formulate an overall plan for the agricultural development of the delta area. These studies relate to the role of the Mekong silt in delta fertility, the agricultural management of heavy clay soils for crop diversification and the problems of salinity intrusion.

Other Programmes

As well as the studies of crop production associated with irrigation in the Lower Mekong Basin, the Committee's work has also extended to other aspects of the rural economy. Again most of the programmes are in co-ordination

with the individual extension programmes of each of the riparian countries. In Northeast Thailand, studies of cattle and buffalo development are already under way. An initial field survey was carried out in 1972 into improvement of pasture under rainfed conditions and the carrying capacity of irrigated pasture.[25] Programmes of pig production development in the Khmer Republic and of general livestock development at the Hat Dok Keo farm, in the Casier Sud scheme and on the Bolevens plateau in Laos have been begun and in the resettlement areas at Nam Pong, Lam Dom Noi and other projects the resettled families have been introduced to poultry raising.

The construction of the major irrigation projects on the Mekong will have a profound effect on the traditional fisheries of the Basin and this too has been a major part of the programme followed to date. There have been a number of pre-impoundment research studies into the planning and execution of post-impoundment developments in order to minimise the deleterious effects of dam construction on fish stocks and to benefit from utilisation of the new reservoir environment. A survey of the Nam Pong reservoir in Northeast Thailand was completed in 1972;[26] in Laos, planned fisheries development in the Nam Ngum reservoir has already had a significant impact on fish supply. On the other hand, studies into the fishery problems of the Tonle Sap lake

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25. UN/ECAFE/Mekong Committee, 1972, op.cit., p.85.

26. Ibid., p.82.

and the Prek Thnot development programme have had to be postponed because of the lack of security. A project for the development of commercial prawn and shrimp fisheries has been designed to offset possible economic losses from dam construction and already these are making an important contribution to exports in the Republic of Viet-Nam.

It can therefore be seen that with a co-ordinated agency like the Mekong Committee, great progress has been made on the investigation and implementation of a major programme for harnessing the potential of the river. More has been accomplished in the years following the foundation of the Mekong Committee than in the half century that preceded it. This may not be totally reflected in the presence of physical water control structures on the mainstream, but in tributary projects, experimental farms and pioneer projects great strides have been made. Nevertheless, it must be admitted that major problems have still to be solved; the nature of the more important will be discussed in the next chapter,

CHAPTER VIII

PROBLEMS OF AGRICULTURAL DEVELOPMENT

It was demonstrated in an earlier chapter that there exists within the Lower Mekong Basin a need for radical change in the traditional pattern of agriculture. The basic subsistence rice monoculture dependent upon an erratic and unreliable rainfall regime is now under the pressures of population increase and heightened consumer desires in the rural areas; a more productive and more diversified agricultural system must be found. Government policy in the four riparian countries of the Lower Mekong Basin is already focused on these requirements, but little can be done without the reduction of the annual threat from environmental hazards which make agricultural production so unstable. The international effort at development of the water resources in the Basin is therefore fundamental to agricultural development and it is right that so much attention should be concentrated on construction of water control facilities in the region.

The Mekong Committee have recognised, however, that the mere physical structures of water resource development are not an end in themselves, nor is their establishment an easy matter. The design of the major structures, particularly the dams and storage reservoirs, the final choice of site, the alignment of the canals and drainage ditches and their minor control structures have also to be decided. Hereafter there remains the task of getting the water to and from the farmers' fields effectively and persuading the farmers themselves to use it.

This latter task involves a whole series of other problems. Newly developed crop varieties, whether paddy or other field crops, require new, often unfamiliar cultivation techniques. The ideal conditions of the demonstration farm do not exist in the field and even pioneer projects may not mirror adequately the conditions of each individual farm which are unique in many respects. Thus techniques carefully tested under experimental conditions may be totally inapplicable to the individual farmer. In any case if a farmer is to invest in any of the new techniques available, most of which require capital outlay, he must be sure of a return on his investment. His original lack of capital which may force him into borrowing funds from elsewhere, may be compounded by a poorly developed local marketing system or an unstable national market in discouraging the required change.

In the present chapter, it is intended to consider some of these problems facing the officers of the riparian governments and the international agency of the Mekong Committee in seeking to get the best results from the development of water resources in the Basin. Some of these problems can only be marginally within their control; others have already claimed considerable attention and could be solved by careful application. Essentially these problems have been divided below into three groups, the technical problems, the economic problems and the social problems. It is clear that this division is rather artificial in that the various factors work together in making more difficult this task of agricultural development, but it may be said to point

towards the main aspects of the problem.

Technical Problems

The Development of Water Resources

In the Lower Mekong Basin, agriculture has been carried out mainly under rainfed conditions and has become closely adapted to these conditions. Nevertheless it is true that the Basin has an important tradition of water control structures, dating back many centuries. A number of local methods of obtaining water for the rice fields have been used and there have also been major structures developed. In the Khmer Republic the artificial fresh water reservoirs and storage tanks constructed at Angkor to preserve a supply of water for the irrigation of the rice fields during the early centuries of the civilisation were among the greatest works of the Khmer kings. The irrigation works were not designed only to solve the water supply problems of the country, but they also protected the soil from erosion by the uncontrolled flooding of the rainy season, controlled the annual inundation of the Great Lake and provided an efficient means of travel and transport at any season of the year. As Hall notes

> 'The Angkor economy and the organisation of society which it entailed depended upon a system of water utilisation so highly complex and artificial that any interference with it could have had extremely serious consequences.' 1

Nor are irrigation systems constructed from locally available materials new features in the north

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1. Hall, D.G.E., "A History of South-East Asia", 1970, p.134.

of Thailand. According to Manich, irrigation projects were constructed by tribal groups (related to the Khmer) inhabiting the Chiang Mai Valley prior to the influx of the Thai people,[2] and while the structures in the Khmer Republic have largely been abandoned since the heyday of Angkor, the systems in Thailand have continued in use. The basic construction has been a weir of bamboo stakes, which, although it is inefficient, is sufficient to divert the flow of the streams in the rainy season into the local canals. Since the bamboo decays very rapidly, it is necessary to repair and reconstruct each year. In addition to the weirs, a whole series of other devices are used in the area to raise water from the canals to the fields; closely woven baskets, scoops, 'dragon bone' pumps and occasionally water-wheels are all employed.[3]

These traditional types of water control structure were generally small-scale developments and even the water-storage tanks of Angkor did not effectively allow extension of cultivation beyond the main season. Nor were most of the indigenous structures effective in controlling high flood levels, which merely broke or overflowed the bamboo weirs. Modern water control development came with the French period in Indochina.

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2. Manich, M.L., quoted in Rose H. Frutchey, "Socio-Economic Observation Study of Existing Irrigation Projects in Thailand", 1969, p.13.

3. Pendleton, Robert L., "Thailand, Aspects of Landscape and Life", 1962, p.140.

When the Vietnamese colonised the Mekong delta, dykes and canals were dug to protect the new agricultural land from flood, but the French protectorate led to more intensive development. According to Fisher

> 'French efforts at strengthening dikes as a protection against exceptional floods began in the late 19th century, but their greatest achievements followed the calamitous floods of 1926, after which many of the main dikes were reinforced to a total thickness of 150 ft. with heights of up to 40 ft. in the central delta.' 4

Rice cultivation increased along with the extension of the canal system.

The scale and type of development to be followed in the schemes of the Mekong Committee are, however, different from even these works. Most involve the building of a dam and an extensive storage reservoir; even the tributary projects cover large areas; in most schemes the extension of cultivation into the dry season is planned. Seasonal control as well as diversion and wider distribution of the normal water flow is sought to give a more regular water supply than that allowed by the rain and river flow alone. These developments pose new problems to the planners and to the farmers of the region, problems which must be solved if the expense of dam construction is to be justified.

Already a number of tributary projects have been constructed in the Mekong Basin seeking to eliminate floods in the rainy season and to secure sufficient water supply for dry season cropping. Since these

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4. Fisher, C.A., "South-east Asia", A Social, Economic and Political Geography, 1964, p.546.

require a vast amount of expenditure, the actual design of each project has to be carefully worked out to give the maximum benefit. The site and design of the dam in relation to the area to be served with irrigation water, the cost of construction, operation and maintenance and the length of the canal distribution system must all be taken into account in making the design decision. Preliminary planning of the irrigation project for engineering work requires a complete study of the physical background of the area in question and the design layout of the main canal in particular must be based on detailed and accurate maps.

The work on the tributary projects to date has taken these aspects of project design very much in mind. Indeed some commentators believe that too much emphasis has been placed on this side of project construction, for the progress of irrigation is not dependent only on the dam construction but also on the establishment of a distribution system to deliver a timely and adequate water supply to the farmers. Puey has suggested indeed that in the Thai context

> ".... the government has spent too much time and money on too many simultaneous big projects in its efforts to bring water to the farms. This should be remedied by changing the policy and trying to make water available to farmers as quickly as possible; ditches and dikes rather than big dams." 5

Evidence from the tributary projects would seem to suggest that this criticism is largely justified.

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5. Puey Ungphakorn, "Thailand's Economic Prospects", Journal of the Siam Society, vol. LVIII, part 2, July 1970, p.135.

At present distribution systems can deliver water to only a small part of the areas where the dams were designed to serve and in many cases the irrigation system is inoperable since the design paid little attention to drainage, operation and possible changes in cropping patterns. Kaufmann, writing again of some of the schemes in Northeast Thailand, considers that

> 'The canals in both the Lam Pao and Nam Pong areas were designed primarily for wet season rice cultivation and are not appropriate under the present set-up for dry season cultivation since none provide adequate drainage. This results in water having to remain in the farmers' fields until those at the end of the line have received theirs.' 6

Other factors have also delayed the establishment of effective distribution systems. In some cases canals are inoperable because of the non-completion of or damage to the head reach and elsewhere they have been poorly constructed; at Nongwai, for example, the concrete lining is already (two or three years after construction) in poor condition, with numerous cracks due to water pressure and sliding embankments.[7] In other cases checks in the main canals and laterals are not sufficient to maintain the water level high enough for continuous operation of the outlets and the water supply is thus concentrated in a limited area. In the design of the smaller canals and distribution ditches, long and narrow ditches without sufficient check gates will again result

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6. Kaufman, Howard K., "Socio-Economic Factors in Farmer Response to Irrigation in Northeast Thailand", 1971, p.17.

7. ADB/Government of Thailand, "Nong Wai Pioneer Project for Irrigated Agriculture", vol. II, 1971, p. X-4.

in insufficient gradient of water flow to serve the whole area planned. Distribution ditches should be laid out to serve the paddy lands with the minimum of disruption to property lines and with as little land consolidation as possible, but this must be set against considerations of expense and length of ditch. It must be decided whether it is worthwhile to line the whole or part of the minor canals comparing expense with possible conveyance loss and service to the farmers. Concrete lined canals would seem to be of greater advantage than earth ditches, since they can minimise conveyance losses, breakages and damage from animals or weed growth, reduce drainage problems and erosion and increase the capacity of the canal to convey water, but they require a high initial and maintenance cost.[8] Because of the initial design of the project, in some cases it has also been found that the water level in the canals can only be raised to the field level in the wet season, while in the dry season the lack of water means that the level is lower than the adjacent area to be irrigated. In this case, it is necessary to use some mechanical device to raise the water, usually a water pump. Provision of these for the farmer also raises the cost of supply.

The problems of project design described above cover a broad spectrum of technical and engineering

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8. Caoili, A.A. et al., "Irrigation and Drainage Principles and Practices", 1967, pp. 85-87.

problems. But the success of irrigation lies not only in the construction of canals and drainage ditches but more in the productivity of the water when applied as an input for crop production. In this respect water supply policy is very important, for the water should be released to the farmers' fields in relation to their crop requirements. Delivery of water to the farmers at the right time and in the right quantity is a very complex task and local irrigation officers have to be well-trained in the operation of the distribution system at the check-points and outlets. These officers also have to have regard for the care and maintenance of the irrigation system and the distribution system at the farm level through communication with the recipient farmers. Indeed a whole extension network is needed to encourage and educate the farmers to give them confidence in the reliability of government services and to make them understand the principle of irrigated farming and the utilisation of the existing ditches and dikes. Demonstration of water management operation and the training of farmers will improve year-round irrigation farming practices. This task can however mean a complete change in attitude on the part of the farmers and can pose massive problems in itself; these will be considered below.

New Seed Varieties

If irrigation can be successfully transmitted to the fields, then the intensification of agricultural production through the application of other aspects of

the new technology of the Green Revolution can be applied. However, the difficulties of application of these various elements should also be recognised.

One new possibility for the application of technology to agriculture is through the breeding of high-yielding varieties of crop. As pointed out in previous chapters the development of high yielding varieties of rice has been an important part of the agricultural development policies of the governments of the four riparian countries of the Lower Mekong Basin. They are particularly important in so far as they not only provide the means for increasing production from the existing crop areas but also help to release paddy land for the cultivation of other crops. The high-yielding varieties are heavily dependent, however, on the efficient control of water and the efficient design of irrigation systems as noted above. In addition, most strains require heavy application of fertilisers to get the maximum results from their use.

The varieties of rice grown in the Lower Mekong Basin suit a wide range of climatic conditions and require a variety of cultivation techniques. The dominant type grown also varies according to the diet of the cultivators; thus in Northeast Thailand and Laos, glutinous rice is generally grown for home consumption and local sale, while in the Khmer Republic and in South Vietnam, people prefer to grow the non-glutinous variety. Within these two basic types, the selection of varieties is very complex and has required great knowledge and experience of local conditions on the part of the farmers.

In the Lower Mekong Basin, however, all the varieties grown, whether glutinous or non-glutinous are of the Indica type; these possess better grain quality, greater resistance to disease in tropical conditions, greater tolerance to infertile soil and a higher adaptability to local circumstances of poor water control than the Japonica strains and their taste is most acceptable to the people of the Basin. The disadvantages of the Indica strains are their long growth period (they are all photo-period sensitive) and their limited response to fertiliser. The main purpose of development of new rice strains in the Lower Mekong Basin has been to retain those useful characteristics of the traditional Indica varieties while removing the disadvantages through crossing with strains of shorter growing-period and higher responsiveness to fertiliser.

The large-scale development of new rice varieties in Southeast Asia began when the Rockefeller Foundation and the Ford Foundation combined to establish the International Rice Research Institute (IRRI) at Los Banos in the Philippines in 1962 with a programme of research, training and international extension. The so-called 'miracle rice', IR-8, was developed by cross-breeding in 1965 and this was officially selected as the first new variety from IRRI in 1966. IR-8 and the newer strain, IR-5, have provided vast opportunities for increasing yields being responsive to fertiliser in a wide range of growing conditions and they are easily capable of doubling the yield obtained from most local varieties in Asia. They are also early maturing, with a growth

period of about 120 days, and are mainly short-stemmed.[9] The short growth period often means greater cropping intensity through multiple or second cropping and improvements in crop rotation are possible.

However, the spread of these new varieties has also necessitated new technical requirements in cultivation. The critical conditions for realising their high yield potential are heavy doses of chemical fertilisers and technically superior water control and management. They have the disadvantages of greater susceptibility to local pests and diseases and they sometimes fail completely in conditions of natural flooding. They demand a more intensive use of water so that even traditional methods of irrigation often do not supply enough water to meet the minimum needs and as Brown has noted,

> 'Wherever data are available, they indicate that the new seeds require more labor than the traditional ones they replace. Farmers who wish to realise the genetic potential of the high-yielding seeds must prepare seed-beds more thoroughly, apply fertiliser more frequently, weed more carefully and use pesticide.' 10

Moreover the manner and the timing of the application of these various inputs vary with the soil fertility and environmental conditions of each particular region.

According to the ADB Regional Seminar on Agriculture in 1969, the direct impact of the high-yielding varieties of rice at the farm level had been almost nil as a result of many limiting factors including the cooking

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9. Brown, Lester, "Seeds of Change", 1970, p.18.

10. Ibid., p. 103.

quality, the short stature, the fact that they are not suitable for rainy season cultivation and the high cost of nitrogen fertiliser.[11] Thus each country has undertaken further work to develop high-yielding rice varieties for their own local conditions, concentrating on improving grain quality, increasing resistance to disease and adaptability to local circumstances and overcoming local consumer resistance. Thailand has started intensive work on a breeding programme since 1966, breeding new varieties by crossing the IR-8 strains with local varieties. The RD-1 and RD-3 strains have been produced by cross-breeding the local variety Luang Tawng and IR-8. A glutinous variety from the Northeast region, Kam-Pai 15, has also been crossbred to give a new glutinous strain RD-2.[12] In the Republic of Viet-Nam, the Accelerated Rice Production Programme was set up in 1968 for seed improvement and adaptative research trials with the goal of achieving self-sufficiency in rice. The new variety IR-20, which possesses the high-yielding quality of IR-8 and IR-5, but the cooking quality of which is better suited to the Vietnamese taste, was introduced in 1970 along with the IR-22 strain which has high resistance to disease and insects, particularly to the stemborer.[13] In Laos, the improved high-yielding non-photo-sensitive varieties have been imported from Thailand, Taiwan and IRRI and introduced to the farmers since 1965,

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11. ADB, "Regional Seminar on Agriculture", 1969, p.212.

12. Sarot Montrakun and Somphot Suwanwaong, "Rice Cultivation", 1971, pp. 15-16.

13. Tran Quang Minh, "Agriculture Development in Viet-Nam", The Vietnam Council on Foreign Relations, p.11.

although research trials continue to evaluate their adaptability and acceptability under Lao conditions. Strains so far developed have had a poor milling quality and face local consumer resistance.[14]

The new varieties are still in the developmental stage in the Lower Mekong Basin, with more work to be done on adaptation to local environmental conditions. The new varieties from IRRI have been confined to non-glutinous varieties which dominate the world rice market and particular problems are to be faced in developing high-yielding glutinous varieties which are preferred in Northeast Thailand and Laos. Indeed as Grist notes

> 'Selection of the most suitable variety for a given area does not depend entirely on which variety will produce the greatest crop; the selected variety must also be suited to market requirement.' [15]

The development and spread of high-yielding crop strains is not only confined to rice, for new varieties of other crops have also been introduced into the Basin. Mention of some of the problems of these crops has been made previously (Chapter 5) and much work has still to be done on adaptation to local conditions. Certain varieties of maize, cotton and kenaf have all done relatively well in Northeast Thailand, but one recently introduced, short-maturing variety of kenaf has been found unresistant to disease under Thai conditions. Problems have also been encountered in keeping seeds pure under farm conditions.

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14. ADB, 1969, op.cit., p.171.

15. Grist, D.H., "Rice", 1959, p.85.

The Use of Chemical Fertiliser and Insecticide

The development of new high-yielding crop varieties and the use of chemical fertilisers and insecticides are closely related in the agricultural development of the Lower Mekong Basin. I.B.R.D. has it that

> '....additional yields from improved seeds would be greater and more certain if the seed were used in combination with suitable and effectively applied fertiliser under conditions of satisfactory water control.' 16

Indeed the premium gained from the introduction of some varieties of new seed is extremely limited without the application of fertiliser. Thus according to the FAO Mission to Siam

> 'It is likely that the yield will be stabilised at a low level unless manure is used to raise the fertility of the soil.' 17

Only a very small amount of fertiliser has traditionally been used in the countries of the Lower Mekong Basin. The crops which have received heavy application of fertiliser have been vegetables, fruits and tobacco and in Vietnam they have been used on the larger plantations, especially those owned by the Europeans. Of the major crops, however, rice is the only one on which farmers have recently begun to apply fertiliser on any scale. Use of insecticide usually follows the trend in the use of fertiliser in order to protect the investment made in the former and its use in the Basin has been even more restricted.

Though the annual import of fertiliser in the riparian countries is now showing an upward trend, this does not necessarily indicate the amounts used each year

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16. I.B.R.D., "A Public Development Program for Thailand", 1959, p67.
17. F.A.O. "Report of the FAO Mission for Siam", 1948, p.31.

because of varying climatic conditions and other factors resulting in the carry-over of supplies. What is certain is that it remains at a very low level even now. Behrman, writing of Thailand in 1963 notes that

> 'Despite the rapid increase of fertiliser imports, however, fertiliser usage per unit area remains low in the Kingdom compared with other areas.' 18

and another report of the same year indicated that in the Northeast region, less than 1 percent of farms used chemical fertilizer in the production of rice.[19] Table VIII.1 moreover shows the total consumption of fertiliser in a number of selected countries; from this it is clear that the riparian countries are backward in their use when compared with such as Taiwan, Japan and the Republic of Korea.

With the introduction of new high-yielding, fertilizer responsive varieties the need for the increased use of chemical fertilizer for agricultural development in the Lower Mekong Basin is clear. Already there is evidence that its use is increasing especially in the irrigation project areas. Ng has noted of the pioneer project at Huey Sithon in the Kalasin province of Northeast Thailand that

> '.... the farmers were more specific about changes in the level of fertilizer application as practically all of them were using some form of fertilizer for their paddy crop, particularly when the Sanphatong variety of glutinous rice is grown.' 20

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18. Behrman, Jere R., "Supply Response in Underdeveloped Agriculture - A Case Study of Four Major Annual Crops in Thailand, 1937-1963", 1968, p.87.

19. Thailand, N.S.O., "Census of Agriculture, Northeast Region", 1963, table 21, p.36.

20. Ng, Ronald C.Y., "The Socio-Economic Conditions in Huey Sithon", Report for F.A.O., vol. I, 1972, p.60.

TABLE VIII.1

PER CAPITA CONSUMPTION OF FERTILIZER

IN SELECTED SOUTHEAST ASIAN COUNTRIES

1962

Country	Total consumption (000 tons)	Per Capita consumption (pounds)	Consumption per arable acre (pounds per acre)
Khmer Republic	0.9	0.3	0.3
Thailand	21.8	1.8	2.0
Republic of Viet-Nam	22.5	3.3	6.3
Taiwan	165.2	30.8	165.2
Japan	1,639.8	37.4	235.8
Republic of Korea	316.1	25.9	139.1
Indonesia	149.4	3.3	7.4
Philippines	105.1	7.8	8.3
India	555.4	2.7	3.0
Burma	4.6	0.4	0.3

Source: A Report on the Thailand Fertilizer Situation and Potential, USOM.

and this was complemented by the fact that

> 'Thirty percent of the farmers had increased the amount of use of farm chemicals for crop protection since the project came into being.' 21

To get the best results, however, it is essential to find the correct methods of fertilizer application and the most successful cultural practices for different crops in different circumstances. For rice alone the requirement of fertilizer in soil of different types varies widely. With little detailed knowledge of soil conditions, nitrogen has been most successfully applied among the major plant nutrients with quite good increases in yield when tested on some of the IRRI-based strains. In Northeast Thailand, for example, the average yield of local rice varieties in a particular test was 1144 kg./ha.; the average yield of the RD-2 variety with a low level of fertiliser application (37.5 kg. of nitrogen per hectare) was as much as 2926 kg./ha., while with a more intensive application of 75 kg./ha. the yield level rose to 3653 kg./ha.[22]

Nevertheless, even more impressive results might be achieved if the most effective practices of manuring crops in respect of type of fertiliser, rate of application and the time and method of application were worked out for specific locations. Especially under field conditions, crops could be damaged by the application of too much fertilizer or its use at the wrong time. The requirements are often quite complex; for the new Thai RD

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21. Ibid., p.61.

22. Sarot and Somphot, op.cit., table 10, p.42.

(Rice Department) varieties, fertilizer is applied three times during cultivation, once in the nursery bed, the second time in the field before transplanting and the third time one month later as a top dressing after water has been removed from the land.[23]

More knowledge is particularly required on manuring in relation to soil composition, since different types of soil give a varying response to a like type of fertilizer. Fertilizer trials conducted on different classes of soil have thus been aimed at the determination of the kinds and optimal quantity of fertilizer which should be applied on various crops. Grist has stated that, on the basis of such experiments,

> 'Phosphates appear to be the chief deficiency in Thailand, although small dressings of nitrogen also seem to be effective.' 24

while Saort has it that the ammonia phosphate (16-20-0) with an application level of 94 kg./ha. was found to be profitable in increasing rice yields in practically all parts of the Kingdom.[25] Grist also quotes the experiments of Coyaud which showed that

> 'In the Khmer Republic, Laos and the Republic of Vietnam nitrogen increased yields over a wide range of conditions, phosphates increased yields on light soils, slightly on clay soils and invariably on alluvial soils, but only phosphates are profitable. The combination of phosphate and nitrogen gives large increases in yield as much as 50 percent in the initial season and 30 to 20 percent in the subsequent two seasons.' 26

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23. Ibid., pp. 29-33.

24. Grist, op.cit., p.200.

25. Sarot and Somphot, op.cit., p.37.

26. Grist, op.cit., p.201.

Present test data in Laos indicates a potential 60 percent yield increase per hectare under experimental conditions.[27]

In the Lower Mekong Basin there is, however, no completed soil survey and the exact requirement of each particular soil is still uncertain even under experimental conditions. The present recommendations are all based on the results of carefully conducted experiments and, as Muscat notes, they are not applicable to field conditions.[28] Field tests have still to be undertaken on almost all soil series. At the village level the typical situation remains that as described by Hendry

> 'As far as can be determined, no study of the soils in the village has ever been made for the purpose of recommending kinds or amount of fertilizer to be used,...the merchants who first introduced fertilizer in the area may have had some idea of what kinds would have suited the soils found there and perhaps offered general advice on quantities to be applied, but this is all. 29

An inventory of soils and their properties would involve a more economical and reliable basis for fertilizer recommendation, implement economically the fertilizer application programmes and minimize the probable occurrence of acute nutrient imbalance. In addition the results of the technical research and soil survey analysis as well as into fertilizer response which are now being undertaken by the Mekong Committee throughout the Basin should make the returns to the individual

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27. ADB, 1969, op.cit., p.171.

28. Muscat, Robert J., "Development Strategy in Thailand - A Study of Economic Growth", 1966, p.142.

29. Hendry, James B., "The Small World of Khanh Hau", 1964, p.66.

farmer greater and make use of fertilizer more attractive to him. However, as noted above, the use of fertilizer will give the maximum returns to the users only when the water control and drainage system is well-managed and when it is used in combination with high-yield, fertilizer-responsive crop varieties.

Possibilities of Mechanization

The combination of new high-yielding crop varieties with fertilizer use and careful water control should enable the achievement of increased yields in the Lower Mekong Basin. As has been noted above, however, the adoption of early-maturing rice varieties and the availability of irrigation water in the dry season may help raise the intensity of cropping in the area and this and the extra work involved in the care of the new varieties may also increase the demand for labour per unit area. Once water is flowing all the year round, the pressure mounts for a reduction in the period between the harvesting of the first crop and the planting of the next.[30] Labour peaks will be intensified and mechanization may be required to reduce these and allow the subsequent crop to be planted on schedule.

Use of machinery is not usually associated with the lowland cultivation of wet rice. Although mechanization in rice production was extended after World War II in response to the urgent need to increase rice output, it was concerned mainly with the larger-scale holdings.

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30. Brown, op.cit., pp. 105-106.

In the Lower Mekong Basin the land available for large-scale production is limited and in most cases the capital cost to the farmer was also prohibitive. Use of machinery must also take into account the local soil conditions and paddy land in the Basin, especially in the Delta and along the flood plains cannot support heavy machinery. Thus to date there has been little development of large-scale mechanization in the region. In the Khmer Republic tractors have been introduced for the ploughing season on the large rice fields of the provinces of Battambang, Kompong Thom, Siemreap, Pursut and Kampot and this has also been extended with success to cotton cultivation.[31] Apart from this large-scale mechanization has been used mainly in central Thailand and increasingly in parts of Vietnam where there is a labour shortage due to the war conditions. For upland cropping, the tractor has had a more widespread use, particularly in the production of corn, sorghum, cotton and sugarcane, although in some areas the slopes are too steep for their use.

Elsewhere the majority of farms in the Lower Mekong Basin are very small and large-scale mechanization is both impractical and costly. Most farms remain equipped with homemade, traditional equipment and tools. According to the 1963 agricultural census of Thailand, less than 2% of the farms in the whole country were

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31. ADB, 1969, op.cit., p.130.

mechanized.[32] If any form of mechanization is to be followed, it must be of a scale practicably used on small, often sub-divided rice holdings and it must be aimed at speeding up the critical tasks of the crop year without reducing the need for labour. To do this would increase underemployment on the farm and add to agrarian problems. Thus work has been concentrated on small-scale machinery of relatively low cost.

Where it is impossible to use heavy tractors and similar machinery, research has been carried out to develop special types of small tractors, water-pumping equipment and other simple machines for rice production. A hand tractor, the so-called 'iron buffalo', has been manufactured, specially designed to work under wet conditions and its use is spreading, particularly in Thailand. Special waterlifting devices, small threshing machines, hand transplanters and portable harvesting machines have all been developed locally to suit the environmental conditions and the farmers' pockets. In both Thailand and Vietnam, the arrival of irrigation systems and drainage facilities has also encouraged farmers to invest heavily in water pumps to further improve the control of water. Such machines help to increase the intensity of cultivation and increase rather than reduce employment; any programme for farm mechanization in the Basin should be formulated with this in mind.

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32. U.S. Department of the Interior, Bureau of Reclamation, "Pa Mong Project - Lower Mekong Basin", Phase I Report, vol. 4, Appendix IV, 1966, p.149.

Economic Problems

Although there are technical difficulties in diffusion of new technology for agricultural development in the Lower Mekong Basin, the success of the whole programme also very much depends on the financial ability of the farming population to invest in it. The new technology of water control facilities, new seed varieties, chemical fertilizers and pesticides will often require much more investment in agriculture on the part of the farmer, not only in the purchase of farm inputs in themselves, but also in improving land quality by clearing and levelling and in hiring labour to ensure the completion of the various tasks on time. A few rich farmers in the Basin will be able to find the capital to pay for the modern inputs and increase the productivity of their land, but most of the farmers of the Lower Mekong Basin are poor. Their small holdings and the frequent occurrence of crop damage give them a low, unreliable income which gives little opportunity of capital accumulation. In recent years, moreover, increased cash income has been accompanied by increased consumer spending rather than by greater saving.

Availability of Credit

To enable the majority of farmers to use the new technology to improve their land productivity, it is therefore necessary to provide capital resources for the initial investment. Traditionally farmers have faced capital shortage through crop failure or as a result of a family emergency such as illness or a particular

ceremony. In such circumstances they have had recourse to traditional, non-institutional loan sources, such as friends and relatives in the village or local merchants. Where the amount required is small this can usually be furnished by relatives and neighbours and the loan is usually interest-free; where larger amounts are required, merchants or rice-millers are able to provide a loan, but in this case the rate of interest charged is uaually quite high. In the Khmer Republic there are reports of moneylenders, usually brokers or millers, charging interest rates of between 3 and 30% per month[33] and this is confirmed in Laos where rates of interest are seldom less than 2.5% per month and may exceed 100% per annum.[34] The situation would seem to be much the same in Thailand and the Republic of Viet-Nam. Such high interest rates reflect the difficulty in serving a large number of scattered farmers with funds of which there can be little real guarantee of repayment in the difficult environmental conditions which prevail.

Although the improvement of water control facilities for the farmers is likely to reduce the risk of loss to the lending agents, the amount of capital available from the non-institutional sources has only been adequate where the need for capital investment in

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33. Munson, Frederick P. et al, "Area Handbook for Cambodia", 1968, pp. 41-42.

34. LeBar, Frank M. and Suddard, Adrienne (eds.), "Laos, its people, its society, its culture", 1963, p.195.

traditional agriculture has remained low. The need for heavier investment in the new technology is likely to create a demand for capital which is beyond the capacity of these cources to supply. Thus the governments of the riparian countries have sought to provide further funds through government institutions and by enlisting the help of commerical banks. Loans from commercial banks are considered to be rather difficult for the small landowners since the banks require a mortgage on the farmers' land. Moreover, since the main role of the commercial banks is in the financing of trade, the amount of credit available for supporting agricultural production is limited.[35] Overall therefore, the government, generally through co-operatives is the most important source of institutional credit available to the farmers. In Vietnam, for example, credit available through co-operatives accounts for four-fifths or more of the institutional agricultural credit.[36]

Each of the riparian governments has established such loan agencies based upon co-operative organisation, the Agricultural Development Bank in Vietnam, the Agricultural Development Organisation and Development Bank in Laos, the Bank for Agriculture and Agricultural

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35. Singh, Mohinder, "Agricultural Cooperative Credit in Asia", in International Cooperative Alliance, "Agricultural Cooperative in South-east Asia", 1967, p.2.

36. Ibid., p.3.

Co-operatives in Thailand and the Royal Office of Co-operation in the Khmer Republic. These agencies can provide fairly large amounts in loans at a low rate of interest, usually no more than 12% per annum. However, throughout the Basin, organisational difficulties have faced the co-operatives and they have often failed to gain the enthusiasm and the confidence of the farmers. Loans are usually given only against a mortgage on real estate, the procedure is often very slow, the loan conditions are sometimes too complicated for the farmers to understand and the use of the loan has to be strictly controlled.[37] In some circumstances the aim of the co-operative has not so much been to increase agricultural production but to relieve small farmers from previous debts thus preventing them from being dispossessed of their mortgaged land by private creditors. Farmers criticise the co-operatives for their complicated procedure which often means that the loans are not made at the time the farmer desires the cash, but on their part the co-operatives, like the non-institutional lenders must also safeguard their money if they are to be financially viable, With the increasing need for agricultural credit, the co-operative movements in the Lower Mekong Basin should be developed and strengthened, but this will require careful examination and re-organisation if they are to be of maximum service to the farmers.

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37. ADB/Government of Thailand, op.cit., pp. VIII-29-33.

Relative cost of production and inputs

Even if the credit can be adequately provided for the farmers of the Basin to invest in the new technological developments, this does not guarantee their adoption and utilisation. The relatively high cost of fertilisers, insecticides and other modern inputs relative to the prices which a farmer receives for his product is a major obstacle to the improvement of crop yields and of farm income. The economic incentive to use fertilizer, for example, will depend on the relation between the price of the fertilizers delivered to him, the additional yield that he can obtain from their application and the additional income he will obtain from the production increase.[38] If the selling price of the crop is low and the value of the increased yield is only slightly higher than the cost of production through using modern inputs, farmers will not change their traditional practices, especially if there is any remaining threat of crop failure. Where there is no adequate water control, it has been estimated by an FAO soil advisor to the government of Thailand that, at the then current commodity prices only 5% of all rice land in the Northeast region can be expected to produce a cash benefit when fertilized.[39]

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38. OECD, "Development Centre Studies, "Supply and Demand Prospects for Fertilizers in Developing Countries", 1968, p.60.

39. USOM/Thailand, "A Report on the Thai Fertilizer Situation and Potential", 1966, p.23.

The cost of fertilizer depends partly on the import price, since there is little indigenous production within the Basin, and partly on the distribution system. Here the difficulty of supplying a large number of small producers with small quantities of fertilizer increases the costs of distribution for the private sector, which also charges high rates of interest on supplies purchased on credit. Reduction of these costs would therefore lead to higher returns for the cultivators and encourage more farmers to invest in the inputs. Here again there is a need for low interest rate credit to enable farmers to make their input purchases as and when they are required as well as a careful consideration of policies which restrict low-cost imports for the protection of expensive home-produced supplies. It may be useful at the initial stage to subsidise fertilizers sold through the government agencies, both as an incentive for farmers to use fertilizer and to give them confidence in the activities of the co-operatives. The riparian governments have taken this step in one form or another; in Thailand, fertilizer for paddy is subsidised to the extent of one half of the cost, while in Vietnam they are distributed free; in Laos the Agricultural Development Organisation has provided modern inputs on credit for repayment when the farmer's crop is harvested.[40]

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40. ECAFE, "Economic Survey of Asia and the Far East", 1968, p. 127 and Far Eastern Economic Review Yearbook 1969, p.217.

Transport Problems

Lower transport costs will also improve the profitability of using modern inputs, but their reduction is dependent upon heavy investment in the widespread provision of both major and minor roads in the Basin. Transportation facilities in rural areas only exist in some parts of the region and there are still large areas where access is difficult and often impossible in the rainy season. Laos, of course, faces the greatest transporation problems, for not only is it isolated from the outside world, but within the country there is little link between the north and south, nor between rural and urban areas.[41] The absence of a railway system and poor roads renders any internal movement of goods difficult and although the Mekong River is significant, the fluctuating level, the difficult rapids and falls make navigation practicable only on certain reaches and at certain times of the year. Elsewhere in the Basin the major problem seems to be village roads which have received little attention from planners and suffer from a general lack of maintenance. The difficulty of access thus produced means high costs and delays in delivery and occasional storage problems for agricultural output.

Indeed, transport is as much a problem in marketing of farmers' produce as it is in supplying them with inputs. Again it reduces the return on the goods and it restricts the scope of the market to which they

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41. ECAFE, "Economic Survey of Asia and the Far East", 1970, p.238.

may be sent. This may be seen on a broad scale in Laos where

> 'In effect, each region is a separate entity, There is little movement of goods from one region to another, and serious marketing problems often arise when a particular product is not produced, processed and consumed within a single area.' 42

This was highlighted in a recent case where rice shortage in the north of the country had pushed price levels very high, while in the southern region, merchants were still exporting the commodity to the Khmer Republic.[43]

Local marketing system

Poor local transport facilities leave the farmers of the Lower Mekong Basin even more dependent on the traditional means of marketing crops, through local merchants and millers. In most cases, this marketing system developed to serve the rice trade. The great majority of the agricultural producers of the Basin are basically subsistence farmers, producing rice for their own consumption, with only the small amount by which their crop exceeds the food needs of their family entering the market. Individual surpluses are small and they are bought by local merchants and mill agents who come to buy at the village. These people play an important role in the domestic trade. As Usher notes,

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42. Embassy of the United States of America, USAID Mission to Laos, "Facts on Foreign Aid to Laos", 1971, p.80.

43. Far Eastern Economic Review, "Pegging the Price of Rice", vol. 84, no. 15, April 1974, p.40.

> 'The rice buyer, known in Thailand as 'the middleman' usually lives in the village with the farmers and often combines rice buying with other commercial activities. The middleman is usually prepared to buy the farmer's rice in smaller quantities than the miller will accept. This gives the farmer the opportunity to sell his rice bit by bit as he needs cash, and the middleman can combine purchases from many farmers into larger lots suitable for sale to millers.' 44

The price the farmer gets is, of course, reduced to account for transport costs. Udhis, talking of the Thai Central Plain, shows, however, that these service charges are not a very large proportion of the total consumer price;

> 'The farmers get as their share approximately 72.19% from what the consumers pay for their rice and the service charge of the wholesalers and retailers of all categories is approximately 12.05%.' 45

This would appear to be quite a reasonable return, but it is also probably true that the farmer could expect even higher prices if the marketing system were improved. Most farmers have no storage facilities and must sell at the generally low prices prevailing at harvest time, rather than taking advantage of the higher prices later in the year. Moreover, the local merchants are frequently in a monopoly position as far as agricultural services are concerned in any particular area. Where the merchant is also the local money-lender the farmer is sometimes obliged to sell to him at a slightly lower price in order to obtain credit. In Vietnam the same situation has prevailed between the landlord and

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44. Usher, Dan, "The Thai Rice Trade", in T.H. Silcock (ed.), "Thailand, Social and Economic Studies in Development", 1967, p.210.

45. Udhis Narkswasdi, "Debt Condition and Rice Trading in the Central Region of Thailand", 1959, p.330.

the tenant. According to Hendry,

> 'In general, landlords were reluctant to extend agricultural credit to their tenants and did so only under unfavourable conditions to the tenants...The date of repayment was set to fall prior to the actual harvest of the crop so that the tenant could not meet his obligations, The landlord would then offer to buy the crop, as yet unharvested, at some fraction of its probable value, one-half to two-thirds. The tenant lost part of the value of his crop, in addition to paying prevailing rates of interest during the life of the loan.' 46

As has been noted above, the shortage of rural credit in the Lower Mekong Basin impels farmers at present to rely heavily upon the rice merchants and landlords for credit and thus leaves them open to such practices.

The middleman system in local marketing has indeed been subject to much criticism in the context of the Lower Mekong Basin. Anderson states that

> 'The argument of exploitation of the rice farmer is based on his lack of knowledge of market conditions and prices, his inability to transport his surplus to a market place where he could seek out potential buyers and his being tied to his creditors by the pledge of his produce to moneylenders or to his open account at the village store.' 47

In providing the means to overcome some of these problems the middleman system is clearly providing a service for the farmer, but it is equally true that he could get a better return if transport and government information and credit services were to be improved. To replace the middleman system would, however, require large capital investments and a large number of well-qualified personnel to be recruited to the government extension services and co-operatives, which can only be a very long term aim.

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46. Hendry, op.cit., pp. 210-211.

47. Anderson, Dole A., "Marketing and Development - The Thailand Experience", 1970, pp.88-89.

World Market Problems for Non-Rice Crops

Although the difficulties of internal marketing may result in a reduction of prices for the producers, for commodities consigned mainly to the export market, the actual price received by the farmer will depend mainly on the world market price. There is indeed little point in encouraging the expansion of a particular crop in the Basin unless it is certain that it will be able to be sold in competition with other producers. It was seen in Chapter IV that, despite the fact that the riparian countries are among the world's major producers of rice, they have little control over world market condtions and it has been the failure to compete in the world market as well as the growing instability of that market that has led to the need to reduce dependence upon rice as an export earner and increasingly diversify agricultural production. Already Thailand has moved away from the four traditional commodities of rice, rubber, tin and teak to other upland crops like maize, kenaf and cassava since 1960 and the other countries of the Lower Mekong Basin desire to follow this example. Whatever their success, the bulk of their future export earnings, with the exception of Laos, seem likely to continue to come from agricultural production. This will mean, therefore, that the whole economy of the Basin will continue to remain seriously exposed to external factors affecting the markets of those agricultural export commodities.

The problems of the world rice market have been described earlier, as well as some problems of the other export crops of the Basin at the present time.

Here it is proposed to review a number of general problems which confront the agricultural planners in the Lower Mekong Basin in their efforts to develop a viable agricultural economy, problems over which generally they have little control. Most of the market for the agricultural products of the developing world continues to lie in the developed, industrialized countries. At the present time, although demand for such products is increasing, the competition between the numerous suppliers of the same commodity is intense. Moreover the importing countries are seeking to keep their costs at as low a level as possible and are seeking not just the cheapest supplies of a particular commodity but equally methods of substituting one product for another. Costs of production vis-a-vis other products, whether natural or synthetic, are therefore becoming as significant as the relative production costs of the same commodity.

Product quality is also an important aspect to be considered in the search for international markets. One of the most important problems that the riparian countries still face in the export market is the poor quality of their produce, often lower than the accepted world standard for raw materials. As already noted above, the export of Thai maize to serve the Japanese demand for cattle feed grew rapidly in the 1960s, but the continued expansion is jeopardised by the failure to improve the quality of the product through the reduction of the high moisture content. Again the inadequate water supplies available for retting kenaf in Thailand's Northeast region result in a poor quality of fibre,

which makes it impossible for Thai kenaf to compete with the inherently higher quality of Indian and Bengali jute. The quality of natural rubber from the Lower Mekong Basin likewise does not meet the requirements of some industrial processes. Improved quality must be sought through the imposition of more strict export standards and more efficient grading control, while greater price differentiation between the various grades of agricultural products would encourage farmers to seek quality improvements themselves.

The low quality of the Lower Mekong Basin rubber products makes them notably vulnerable from the competition of synthetic rubber. This has a generally higher wear resistance, a more constant quality and can be easily adapted to technical requirements. The failure of the natural rubber producers to meet increased demands after World War II led to the rapid increase of the synthetic product and to compete in price terms natural rubber must now be produced as cheaply as possible. Recent substantial increases in the price of oil products from which synthetic rubber is produced have brought natural rubber production into a much more competitive position once more with scope for a large increase in production. Whether the old, run-down estates of the Lower Mekong Basin will be able to take advantage of the new situation depends on their ability to replant and re-equip. Another commodity favoured by these changes is kenaf; the greater cost of synthetic packing materials reduces the threat to its traditional gunny bag market and may give it a more assured future.

Nevertheless kenaf cannot ignore the continued competition from other natural products, not only from jute, but from other hard fibre producers in Africa and South America. As these producers also seek to expand the alternatives open to the consuming countries will allow a choice according to price and quality. Indeed the availability of substitutes for many tropical products is a major problem for the producers. In the last year or so, the demand for the grain and starch root crops of the Lower Mekong Basin has increased rapidly from the European countries, as a result of the high prices for wheat and barley resulting from failures in the cereal harvests of major producers like the U.S.S.R. and China. Again, the demand for oil seeds like peanuts, soyabean, mung bean and sesame increased as a result of the reduction of protein supplies from other sources. The question remains whether these upsurges in demand are likely to continue as each emergency recedes.

Export markets in the developed world are also at the mercy of the economic policies of the importing countries. Protection of domestic markets by tariff barriers or quota restrictions for balance of payments purposes may hit the producers, especially where exports are highly dependent on a single country. Japan is Thailand's main market for rubber, maize and kenaf and restriction of these imports would have a severe effect on Thailand's export earnings; by contrast, reciprocal action on the part of Thailand on Japan's exports would have only a marginal effect on Japan's economic position. The former territories of French Indochina still maintain

very close links with France which hold much the same danger.

In addition to the difficulties of marketing relations with the developed countries, the countries of the Lower Mekong Basin must also take into account the competition from their fellow developing countries. Increased production of a particular commodity by a number of producers will overload the market and lead to the depression of prices. Farmers who entered the market when high prices prevailed will then be hit as the demand falls and along with it the price. International marketing agreements can reduce the competition between primary producers to the benefit of all, but in a free economy it will be difficult to control sudden expansions of production in response to market forces. However, Indonesia and Thailand have signed an agreement not to compete with one another in maize marketing and to exchange information and experience with respect to marketing and production[48] and recent discussions have taken place to re-assess the position of the natural rubber producers of the region in the light of the new market changes.[49]

One way of stabilising market conditions for the potential export commodities is the development of processing industries in the exporting countries themselves. In the Lower Mekong Basin, rice milling, sugar

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48. Bank of Thailand, "Monthly Bulletin", vol.XII, no.5, 1972, p.8.

49. Atkinson, Kim, "Rubber - Exploiting a New Image", Far Eastern Economic Review, vol. 84, no.13, April 1974, pp. 39-40.

milling, fruit and vegetable canning, vegetable oil extraction, feed mixing, processing of rubber products and textile manufacture are all agro-industries which could benefit the course of agricultural modernisation. In addition, an expansion of the livestock industry alongside agriculture would offer a market for increased cereal production. The attraction of multi-national food processing concerns into the region would help to make up for the lack of marketing and processing knowledge of these products and help the countries of the Lower Mekong Basin to gain access to wider markets.[50]

Social Problems of Development

Attitude to Innovation

The solution of the technical problems of the Green Revolution and the careful organisation of marketing and supply channels, credit services and even processing facilities for farmers' produce will all be to little avail if few of the farmers within the Lower Mekong Basin feel the need to take advantage of the new opportunities. The adoption of the new technology requires fundamental changes in farming practices and a revaluation of long-held habits. Some farmers will feel that they are unable to break with their former traditions; others may require stronger incentives than it is possible to provide. The farmers' attitude to the new ideas of agricultural development is, of course closely related to the economic and technical factors

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50. Brown, op.cit., p.162.

that were mentioned above. Each household head will weigh up the relative profitability or risk involved in the use of each innovation and each will spend money on the new technology only when he is sure of the result of such investment in terms of the production and return that he receives. Indeed the response to market opportunities in some parts of the Lower Mekong Basin would suggest that farmers are highly responsive to obviously profitable innovation and Kaufman is optimistic in believing that

> 'Agricultural innovation would be readily accepted if the farmer could see monetary gain. Most farmers, when they can afford it, are eager to employ insecticides, fertilizers, improved seeds. They are prepared to plant a completely new type of crop, employing new farming techniques.' 51

On the other hand, cultural factors may be present which make this response rather more difficult for some farmers and the lack of response of a few may have the effect of slowing the whole process of modernization. It is by no means certain that individual farmers have the same idea of what constitutes profitability. For some the traditional way of life of the dry season may be more valuable than the possible return to be gained from increasing crop production. Others certainly will weigh the return from dry season cropping against that which may be derived from off-farm employment at this time of the year, a feature which has become part of the way of life of many households. If the return from cropping is notably higher than that from the former dry season occupation, then it is probable that the farmer will be interested in investing in cultivation.

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51. Kaufman, op.cit., p.54.

Inheritance and Land Tenure Pattern

Certainly the response to the new opportunities would seem not to be a direct response to economic incentive, but rather a response coloured by individuals' psychological drives, their cultural understanding of life and their social institutions.[52] Cultural factors may prevent families from taking part in new enterprises. Kaufman notes, for example, the problem relating to the inheritance pattern:

> 'The custom of the son-in-law living with the bride's family and working for his parents-in-law serves as a deterrent to second cropping in that the son-in-law has little incentive to labour during the hot dry months since all profit will accrue to his parents-in-law. It is only after he has raised children of his own that he may be allowed to keep his full earning.' 53

In such a case the son-in-law might well prefer to take part in off-farm labour which brings him personally a source of cash income. This would then leave the household as a whole short of the necessary labour for dry season cropping. Thus if the head of the household desires to enter into cultivation he must restrict the area planted or else hire labour. The latter would naturally eat up the profits to be made by the family and few families have funds for hiring in any case; the farmer would therefore be unlikely to take part in the new opportunity.

A particular problem affecting ability to innovate is the method of land ownership. In areas where most of

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52. Ingersoll, Jasper, "The Social Feasibility of Pa Mong Irrigation - Requirements and Realities", 1969, p.75.

53. Kaufman, op.cit., p.23.

the land is cultivated by tenants, as was the case in the delta of South Vietnam before the advent of the land reform programmes, this system of land tenure can inhibit technological improvements. According to Schickele

> 'These land-tenure conditions strongly influence agricultural development because they generate much of the social and political climate, many of the human aspirations and fears, economic incentives and obstacles for farmers in their struggle for a better life.' 54

Basically the problem is that farmers who are tenants may be less willing to innovate or incline to improve the land if a large part of their produce goes to the landlord or if they have no security of tenure. This may be particularly the case with the share-cropping system, in which the tenant only receives a standard percentage of any increase in productivity he manages to attain. In essence, he must judge the profitability of an investment in terms of this share of the produce alone. The system makes it doubly difficult for the tenant to accumulate any capital to which to pay for any improvements. In Vietnam, land reform programmes have improved the traditional situation and it may be that the chaos brought about by warfare will also make the transfer of land from landlord to former tenant a more tractable problem.

The actions of their fellows will also affect farmers' willingness to innovate. Where farmers depend on reciprocal labour agreements, the failure of some farmers to take part in a new enterprise may leave those

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54. Schickele, Rainer, "Agrarian Revolution and Economic Progress", 1968, p.162.

who do take part without the benefit of their assistance at the periods of heavy labour requirement. On the other hand, the difficulty of leaving a plot unworked in the midst of others being cropped is testified by the growth of a heavy, not easily cleared weed cover. Conversely where one farmer is alone in his efforts his crop is likely to be the centre of attraction for all the pests in the area.

The results of such a pioneer will clearly have an important effect on his neighbours. Commenting on the desire to modernise in Vietnam, Lan has noted that

> 'Many farmers throughout Vietnam request the new varieties. They are eager to try it and many do not wait to join the government-assisted programs. They are buying the seed themselves, because the word of 'Than Nong's high yields' has spread throughout the country.' 55

Conversely, the failure of the first innovators will discourage other farmers from changing from their normal practices. Too often government-sponsored schemes in the Basin have been rushed ahead with disastrous consequences. As Long agrees

> 'The government must make sure that its recommendations are sound; that its improved seed will produce higher yields under field conditions; that the use of fertilizer will be profitable at the prevailing prices of fertilizer and crops; and perhaps most important that a market exists in which new products can be sold at a profit. Past failures along the above lines have led to a certain amount of disillusionment on the part of the farmer and make it more difficult to persuade farmers to adopt other innovations.' 56

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55. Lan, Pham Huy quoted in Tran Quang Minh, op.cit.,p.9.

56. Long, Francis F. et al, "Economic and Social Conditions Among Farmers in Changwad Khon Kaen", 1963, p.57.

Efficiency of Irrigation Transmission

Since improvements in water control are at the heart of much of the effort towards agricultural development, in this respect it is particularly important to ensure effective systems of irrigation or drainage. Where the farmers are inexperienced in the working of an irrigation system, failure to supply water in the right quantities or at the right time causes a loss of morale and can lead to the total destruction of a crop. At the Nongwai (Nam Pong) irrigation scheme in Northeast Thailand, a recent report pointed out that some farmers had lost faith in the working of the project during the dry season as a result of failures during the wet season. Most were pleased to have an abundant supply of supplementary irrigation water, but the supply was erratic. According to the report

> '... the farmers are never sure about the availability of water when needed or whether the flow will stop when they want their fields to dry. The water supply through the mostly gateless intakes of the irrigation blocks may be interrupted or start at unpredictable times and without warning.' 57

The net result of this was that the farmers would not risk investment in what they regarded as the still more risky dry season cropping.

The problem of supply of irrigation water does not only lie with the administrators of the irrigation system. The lack of experience among the farming

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57. ADB/Government of Thailand, op.cit., p.X-5.

population also causes problems for the farmers themselves. Since in large parts of Northeast Thailand, Laos and the Khmer Republic water supply of any kind is a problem during the dry season, the presence of canals and water storage facilities is welcomed for domestic use as well as irrigation. The local population makes use of the canals for washing, bathing, drinking and in some cases for buffalo wallows even before they are effectively delivering water and as a result the canal linings become damaged and hinder their planned function.[58] Equally important is the lack of co-operation and understanding among farmers in their use of the available water. It is clear that misuse of resources by those farmers close to the turn-out of an irrigation ditch may result in insufficient water for those at the end of long, unlined ditches. Frutchey instances a case from one of the older irrigation projects in Thailand:

> 'One farmer was unable to obtain sufficient water for transplanting purposes. Water for his fields was received from a newly constructed RID field ditch but had to flow through several paddy fields belonging to other farmers. In this case the adjacent paddy, closer to the ditch, was lower and the owner refused to allow water to become sufficiently deep to flow to the slightly higher paddy fields. Prior to the construction of the new fields ditch, this farmer received his water directly from the main canal and always had sufficient water.' [59]

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58. Kaufman, op.cit., p.17.

59. Frutchey, Rose H., "Socio-Economic Observation Study of Existing Irrigation Projects in Thailand", 1969, p.140.

Such problems force the disadvantaged farmer to further expense in the purchase of a water pump, the excavation of another ditch or the reduction in the level of his fields, expenses which he might ill afford and which might prevent his taking part in the use of the water.

Education and Extension

The education of the farmers in the use of the irrigation water, particularly in relation to the new crop varieties, which, in the case of rice, often do not need the same level of water as the traditional strains, is one of the major problems of achieving the successful spread of the new technology. Much depends on effective communication between the water administration agency and the farmers, although this extends equally to those trying to encourage the spread of all other aspects of the new technology. Some of the problems of communication are fundamental. As Kaufman notes of the Northeast of Thailand, the use of a different dialect by the extension officers is quite a barrier. Although local farmers understood the central Thai speech, they tended to find prolonged concentration more difficult when listening to non-local speakers.[60]

Equally important is the availability of the extension officials and their understanding of the farmers' problems. Regular visits to the villages are required during which techniques can be demonstrated to the farmers and at which they can make further enquiries

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60. Kaufman, op.cit., p.136.

and carry out discussions. As has been noted, most farmers do not lack initiative but the majority need a certain degree of advice and guidance if they are to be motivated towards adoption of innovation. Badly trained and intolerant extension officers can have as disastrous a result as a total drought on the farmers' willingness to take part. An IBRD report observed

> 'An extension worker must be a man of patience, prepared to spend considerable time with the farmers, to listen to their troubles and to win the friendship and confidence of at least a few in each village.' 61

Confidence in the extension officer can mean confidence in the package he is trying to spread.

Once the confidence is gained the extension agents can set about the task of ensuring the best and most profitable use of their investment. Careful demonstration of new techniques is required if waste of water, fertilizer and improved seeds is to be avoided. As Hendry notes, local experimentation may in time give adequate results, but there are dangers in this approach. As Lan has observed of the spread of fertilizer in Vietnam,

> 'Now many peasants have to be curbed in their enthusiasm, for they are inclined to apply more fertilizer than the crop can absorb profitably.' 62

Here the spread of innovation has been of little difficulty, but on the other hand misuse can be as great a problem in agricultural development as non-use.

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61. I.B.R.D., op.cit., p.57.

62. Lan, Pham Huy quoted in Tran Quang Minh, op.cit., p.13.

Resettlement and the Strategy for non-irrigated areas

The problems of re-adjustment to new economic circumstances made possible by the development of water resources and other technical improvements will not only be felt by those farmers directly benefitting from the construction of water control facilities. The construction of dams and reservoirs can also affect the rural population in an adverse manner, changing the lives of those farmers with land in the area inundated by the reservoir development. These farmers must be evacuated from the land that will be flooded and provision made for their future livelihood through compensation payments, resettlement schemes of both. In addition to those farmers whose land is inundated moreover, the provision of irrigation and flood control facilities, selective as this must be, will put sections of the farming population in an underprivileged position compared with their neighbours.

Such problems should not be ignored by the planners, least of all those concerned with water resource development. The overall success of a project must be judged partly in terms of the provision it makes for those outside it. Areas which cannot be reached by irrigation water are often marginal in nature, with poor soils scarcely suitable for rice cultivation. In the Khorat Plateau the basic problem is water supply. Even in the wet season

> '.... large variation in the timing and amount of rainfall make rice growing so hazardous that there is a likelihood of losing most of the crop one year in three. Unlike the villages of the flood plain, a single good year is not likely to provide a sufficient stock of grain to carry through poor years should they follow. To some degree, the meteorological hazards are exacerbated by poor water control...On the whole it is fair to state that virtually all the fields are unirrigable by any feasible techniques.' 63

Beside the soon-to-be irrigated areas, these uplands lack the base from which to generate agricultural development and improved living standards for their inhabitants. Clearly for those close to the irrigable areas, it may be possible either to obtain land within these or enter wage employment with one of the participant farmers. This latter recourse leads, of course, to the creation of a division in the society between landlords and landless labourers and this may be an unacceptable trend to the riparian governments. In any case, it cannot solve the problem of all the upland zone. Other stragegies must be developed to give these people a share in the anticipated increased prosperity that should come with the development of the new technology.

Provision has at least been made for the other group who have missed out as a result of water resource development. Where irrigation and water storage facilities have been built, the farmers whose land has been drowned by the creation of the reservoir have been offered alternative plots in a planned resettlement area.

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63. Hill, R.D. "Upland-Lowland Contrasts in the Lam Pao Area, Northeast Thailand", 1973; p.8.

These resettlement schemes have normally been located, however, in the upland zone with little land available for the traditional rice cultivation. Those farmers who take up residence on these schemes are therefore obliged to change their farming practices to the cultivation of those enterprises with which they have had little or no experiences. Whereas previously they grew their own subsistence crop of rice, now they have to buy rice from the proceeds of their upland cash cropping at a price usually two or three times the price level they would have obtained from the sale of any rice surplus. Subject to crop failure as before, they are now open to the hazard of falling prices for their cash crop. Hill instances the situation in the Lam Pao resettlement area:

> 'Villagers exist upon the proceeds from the sale of cassava, and while farmers have sufficient land to grow this....on their own farmland, the people can get by. However, cassava growing on 15 rai holdings is ultimately self-limiting since in the long run, yields will fall first to levels which give a cash return inadequate to purchase desired quantities of rice and other household necessities, and later possibly even to near starvation levels.' 64

Such a change in life style is really a major problem for those whose land has been flooded and many farmers have shunned the resettlement zones and instead have migrated to other areas where they use their compensation to clear or purchase paddy land. However, only farmers who have a land registration certificate can claim compensation and even this is not particularly

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64. Ibid., p.9.

generous. Moreover it is those best able to move who ignore the settlement areas. As Kaufman notes,

> 'It must be noted that 50 percent of the evacuees from Ubonratana and 60 percent from Lam Pao went elsewhere to renew their livelihood. Those that went to the resettlements did so out of necessity. For them, there was no choice.' 65

Indeed, it would seem that those who enter the resettlement areas are the poorer older sections of the community and once there they remain discontented with the new life but are unable to change it fundamentally. The pattern of settlement in these areas often means that any vestiges of the former village life are destroyed and the economic and social relations which were of such importance are denied to those who need them. Former sources of credit in the village may disappear and the the sources of supplementary labour assistance may also have gone. The problems of such settlements indicate the value of a recent stress by the Mekong Committee on the study of these areas.[66]

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65. Kaufman, op.cit., p.86.

66. Investigations have been taking place throughout the Basin into resettlement problems and a number of reports have been produced or are pending notably for the Lam Dom Noi in Northeast Thailand and for various parts of Chiang Rai province.

CHAPTER IX

THE PRESENT SITUATION AND FUTURE PROSPECTS

The economies of the four countries of the Lower Mekong Basin are still overwhelmingly dependent on agriculture. In the Khmer Republic and the Republic of Viet-Nam, there has been some development of the industrial sector, but in the Northeast region of Thailand and especially in Laos, this sector is almost non-existent. In all four countries over 80 percent of the population lives in rural areas and a similar proportion of the working population is engaged in agriculture. Agricultural production accounts, on the average, for about 30-40 percent of the national income of the countries of the Basin and in terms of export earnings, agricultural products again dominate.

The position of agriculture is such that the state of each national economy is heavily dependent on the performance of agriculture. The small industrial sector will find it hard to develop without a prosperous rural market for its goods. Social problems will arise if income disparities between the rural and urban sectors encourage migration from the countryside, draining that sector of its more progressive elements and producing problems of housing and public service facilities in the towns.

Unfortunately the agricultural economies of the Lower Mekong Basin have not progressed far beyond the subsistence level, of providing for the immediate food requirements of the cultivators themselves. Agriculture in the region is dominated by a single enterprise,

the cultivation of wet rice. This crop is still grown mainly as a subsistence enterprise, but in the last century farmers in the Basin have been encouraged to produce a surplus to their immediate needs and the sale of paddy has also become the major source of cash income for the rural population. In the plain of Cambodia and the delta of Vietnam, the French colonial power encouraged the extension of rice cultivation for export and the area continued to produce a surplus until the advent of the Indochina war. In Thailand the backward Northeast region also played a part in the expansion of the rice export economy of that country.

The expansion of rice production in the Lower Mekong Basin was the result mainly of an expansion of planted area. The traditional practices of cultivation, formulated over many years, continued throughout this expansion. These cultivation practices have been closely adapted to the prevalent climatic conditions and agriculture is almost everywhere restricted to the season of the southwest monsoon which brings almost all the year's rainfall over the greater part of the Basin. Not only is the rainfall highly concentrated, but it tends to be unreliable from year to year both in amount and in timing. In their agricultural practices farmers try to take these characteristics into account, responses in the various parts of the Basin depending on the local environmental conditions and leading to different choices over varieties of rice grown, planting techniques and land holding patterns particularly.

Despite these adaptations of cultivation technique, the rice economy of the Lower Mekong Basin is characterised by low productivity. Every year part of the Basin is affected by heavy crop loss. (See Chapter III, Table III.2 and III.3). In the valley bottoms, the main threat arises from flooding in years of heavy rainfall; on the higher lands, drought conditions can be a problem in the drier years. In these circumstances annual production levels have tended to be erratic and few farmers can rely on the production of a regular surplus for sale to obtain a reliable cash income.[1]

In the last two decades the traditional semi-subsistent rice economy of the Lower Mekong Basin with its low level of productivity arising from unreliable environmental conditions has been under increasing pressure. Population has been rising steadily in the Basin at rates of up to 3.0 percent per annum and, with an overwhelmingly youthful population structure, these high levels of increase are likely to be maintained for some years to come. Traditionally population increase has been compensated by an increase in cultivated area and by population migration to less densely inhabited parts of the Basin.[2] At the present time, however, the

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1. Platenius, Hans, "The North-East of Thailand, Its Problems and Potentialities", 1963, p.61.

2. Ng, Ronald C.Y., "Some Land-Use Problems of North-east Thailand", Modern Asian Studies, Vol. 4, Part 1, 1970, p.26.

area of land suitable for paddy cultivation and not yet densely occupied is very small; already cultivation has been extended to unsuitable land of low fertility and poor long-term prospects.

If the increasing population of the Lower Mekong Basin is to be supplied with food without import, either the present export surplus will disappear or production will have to be increased off existing land resources. At present, as a result of the warfare, only Thailand has been able to maintain a surplus situation, but, as the shortages of 1973 have indicated, this too will disappear unless productivity is increased. Mere provision of food requirements, moreover, cannot be the whole aim. The population of the Lower Mekong Basin has been drawn more and more into the commercial economy. Even the rural population now need a substantial cash income to purchase goods which previously they made themselves or which, previously held as luxuries, are now seen as necessities. It is not enough for rice production merely to keep pace with population increase; farmers are seeking some regular source of income to fulfil their new consumer needs and it must be doubtful if commercial rice cultivation under the existing methods of cultivation can provide that regular cash income. Even if a regular surplus could be provided, the unsettled state of the world market for rice must also be taken into account. Although the last two years have seen a deficit situation in world grain markets, this may prove to be only a hiatus in a long term trend of increased production which brought severe price falls up to 1971.

Certain traditional markets of the rice exporters of the Lower Mekong Basin do seem to be approaching closer to cereal self-sufficiency and the overall outlook for the rice exporting countries remains in doubt. This provides particular difficulties for Thailand, but given peace, the Khmer Republic and Vietnam are also potential exporters once again.

Such difficulties suggest that the future of agricultural development in the Lower Mekong Basin should not depend heavily upon the traditional rice crop. Efforts should be made to at least maintain self-sufficiency in cereal production, but at the same time there should be diversification into other crops and enterprises. It is true that in the traditional agriculture there were elements of diversification, but these were practised on a subsistence basis and were strictly secondary to rice. Livestock were raised very much for farm work, although the Northeast of Thailand has tended to have a surplus for export to the Central Plain of Thailand and elsewhere. Expansion of livestock rearing enterprises would seem to require extensive improvements in both the quality of pasture and in disease control. Similar problems also confront the other traditional farm enterprise, fishing, which has formed an important source of protein for most farm families in the region. In most cases the catch is very small and purely for subsistence; only in the Great Lake and in some of the major streams does it become a commercial activity and even here the lack of modern facilities like cold storage reduces the scope of the market.

In the traditional economy most of the non-rice crops were grown on a very small scale for home consumption, these including tobacco, chillies, cotton and peanuts. The major non-rice crops grown in the Basin at the present time represent fairly recent additions to the economy. Rubber has played an important role in the export economy of both the Khmer Republic and Vietnam since its introduction by the French in the colonial period. More recently, the expansion of maize cultivation in the Khmer Republic and Northeast Thailand and also kenaf and cassava in the latter region has been more of a response to the desire of the local farming population for a source of cash income. Unfortunately expansion of these activities in the Basin also has its problems. Rubber is, in any case, overwhelmingly a plantation crop and its production in large estates still dominated by French capital affects only a small percentage of the rural population. It is also very much affected by the price movements on the international market, where competition from lower cost natural rubber producers like Malaysia and from synthetics make it particularly vulnerable. The market for kenaf is also unstable in that the crop is a jute substitute and depends on the level of production in major jute growing countries like India and Bangladesh for its price from year to year. Poor processing facilities also jeopardise expansion. In the case of maize and cassava quality control is also a problem, with high moisture content limiting the expansion of the external market. In Thailand, although the Northeast led the early expansion of maize cultivation, this area has subsequently lost

ground to the areas outside the Basin's limits in the northern Central Plain.

Most of these more recent introductions thus do not seem to be capable of forming a basis for stable agricultural development in the Lower Mekong Basin. Not only do they face market and quality control problems, but most of the expansion of these crops has taken place in the uplands on poor soils and sometimes on very steep slopes. The dangers of loss of fertility and soil erosion are already being seen in some localities. It is considered that the wiser strategy for agricultural development in the Basin lies in the further development of the lowland areas. Here the introduction of improved methods of cultivation for the subsistence rice crop and high-yielding crop strains is envisaged to lead to much improved paddy yields and the reduction of the rice acreage to allow the cultivation of other crops on the lowland.

The governments of the four riparian countries of the Lower Mekong Basin have generally recognised this need to improve the productivity of the staple rice crop, so as to make way for a further diversification of the agricultural economy through the cultivation of cash crops giving the rural population a steady source of cash income. Since the Second World War and particularly since the three territories of French Indochina gained independence in 1954, each country has established a variety of agencies designed to improve the situation in the rural areas. The various national plans have also laid a heavy stress on agricultural development. Research stations have been established throughout the

Basin to carry out experiments into improvements in crop strains, livestock breeding and other technological improvements and agencies to pass on the results of this research to the farming population have been expanded. Largely through government organised co-operatives new sources of credit and channels of supply and marketing have been established. In addition extensive investment has been made in the provision of basic infrastructure of roads and other communications facilities, electricity supplies and social services and small scale irrigation projects. Some of these programmes have been held up as a result of the political situation and in Vietnam and Laos particularly, government planning has been of necessity on a year-to-year basis. Nevertheless some progress has been made everywhere in the development of a modern agricultural sector.

In the course of individual government planning for agriculture, however, it has generally been recognised that a fundamental requirement for the improvement of agricultural productivity is the reduction of environmental hazards which threaten the farmer each year. In the provision of infrastructural facilities, the individual governments and especially Thailand in her Northeast region have sought to provide water control structures. These facilities have been mainly small tanks or reservoirs in individual river valleys. If water control in the Lower Mekong Basin is to be improved to any major extent, a much more wide ranging plan was required. The damming of individual headstreams can have little effect on the flooding of the major tributary valleys in the region and they can certainly not have

any major influence on the mainstream of the Mekong, particularly in the delta and around the shores of the Tonle Sap. Potentially its greatest resource, the Mekong River in its uncontrolled state is the Basin's greatest environmental hazard. Although some attempts had been made by French colonial engineers to control its flow in the Vietnam delta, unless other provisions were to be made upstream this could only be of limited effectiveness. The call for improvement of water control in the Lower Mekong Basin involves control of the Mekong River and its major tributaries; control of the mainstream calls for an integrated Basin-wide approach involving co-operation between all four riparian countries.

Even if the need for such co-ordination between the riparian countries in the Lower Mekong Basin was evident, the resources of the four countries are such that without international co-operation, little could have been achieved. Thus the foundation of the Mekong Committee under the auspices of the United Nations was fundamental to any attempt to control the river and improve the prospects for agricultural development. In fact the Mekong project's overall strategy does not only involve provision for agricultural development. The control and storage of water, which will benefit agriculture directly through flood prevention and irrigation works, will also enable the generation of hydro-electric power in vast quantities, the improvement of navigation, the development of fisheries and other related water resource developments. All of these should, on the other hand, help to improve the living standards of the

rural population and help to generate development in the agricultural sector in a less direct manner.

To date, the foundation of the Mekong Committee and its seventeen years of work might appear to have been of little effect, although much more is known about the river and its potential resources and the feasibility of possible projects has now been studied in detail. In fact, much useful work has been achieved in connection with such developments, with the feasibility studies pointing to the projects of the greatest priority. Nevertheless, the ambitious mainstream projects which immediately catch the imagination are in the future; indeed, serious questions are being asked, for both political and economic reasons, of whether these projects should go ahead at all.

At the present time, more concrete have been the results from the other projects co-ordinated under the Mekong Committee. Despite the unsettled political situation, each of the riparian countries can boast one or more major tributary water control projects, involving the construction of dams and associated irrigation or hydro-electricity generation works. Alongside the irrigation projects there have been developed a series of experimental stations designed to test and improve cultivation practices for a wide variety of crops under irrigation in the local environmental conditions. The results of the research stations' experiments are then tried out in more truly field conditions through the development of the pioneer projects in certain parts of the irrigated areas. In each of these schemes, attempts have been made throughout to co-ordinate with the work

of the individual national agricultural development programmes.

Although much of this work has been unspectacular and there have been many problems, both inside the projects and from the difficulties of external security, much has been very valuable, not least in demonstrating just what problems do arise in attempting a major transformation of traditional rain-fed agriculture to commercial irrigated agriculture. The difficulties have been numerous and varied. Technical problems have arisen in relation to the design and lay-out of the irrigation systems themselves and in the development of new crop varieties acceptable both to the farming population and to the peculiar local environmental conditions. As a result extensive research has been carried out into cross-breeding of rice varieties in particular.

Other experience has emphasised particular economic and social problems of the transition. It has been shown clearly that, however well a crop will grow in a particular environmental context, it will not benefit the farmer unless there are adequate local marketing channels offering him a price profitable in comparison with his costs of production. If these production costs are increased through the need to employ extra labour or by the poor availability of chemical fertiliser and pesticides, the farmer may be little better off than before. Poor local transport facilities may also increase the farmers' costs and this is a particular problem in Laos, where even the main lines of communication linking the different regions of the country are poorly developed.

Further problems have arisen through the sheer inexperience of the farmers of the Basin in the workings of an irrigation system. Disputes have arisen over the timing and allocation of water supply which have emphasised the technical shortcomings of the supply system. Some farmers, disillusioned by the slow arrival of their water supplies, have misused the distribution system and the minor canals and farm ditches have become badly damaged, adding to the problems of distribution to others. Although the problems inside the irrigable areas are important, the relationship between these areas and those not favoured with irrigation water has also drawn very serious attention from the planners of the Mekong office. Problems of resettlement of those families flooded out by reservoir development are the subject of extensive research to investigate problems of adaptation to upland cultivation and the heavy turnover of families in these areas. Attention is also being given to developing a planning strategy for the non-irrigated areas in order to avoid the growth of disparities in development between these and the irrigated zones.

These various problems must be solved if the full benefit of the development of water control facilities in the Basin is to be realised. However, the experience gained in tackling these problems in the tributary projects and in their associated experimental stations and pioneer schemes will certainly aid the more profitable implementation of the mainstream projects as the plans for these mature after 1980. Until that time it is anticipated that developments in the tributary projects will provide all the extra electric power

required in the region and will increase the area of irrigated agriculture to as large an extent as can be handled by the available resources in the riparian countries at that time.

The question must be asked, however, if, even after 1980, the projects planned for the Mekong mainstream are feasible or even necessary. The massive expense involved in the construction of such schemes as Pa Mong or Sambor is clearly beyond the resources of the riparian countries themsleves, even if they were able to make the maximum investment in this direction. It has also been suggested that the vast amounts of energy that such a scheme as Pa Mong would generate would be far beyond the immediate needs of the tributary areas of Laos and Northeast Thailand, although transmission to Central Thailand in this particular case would certainly be feasible. The local capacity to administer the vast irrigation system to be constructed even under the first phase of Pa Mong must also be in doubt. On the other hand, recent increases in the price of petroleum have certainly improved the cost-benefit viability of such projects as Pa Mong and the benefits must not be seen purely in relation to the immediate area to be supplied with irrigation water and power facilities. Benefits will also accrue far downstream from such schemes, notably through even small reductions in flood levels in the delta, the Mekong plain and at the mouths of some tributary streams.

Certainly without some effort to construct major water control facilities on the major streams of

the Lower Mekong Basin, the future prospects for the Lower Mekong Basin do not seem very encouraging. Agriculture seems likely to remain the most important sector in the economy of the whole Basin for many years to come. Industrial developments will probably centre on the processing of agricultural raw materials, although with large-scale availability of hydro-electric power there may be scope for developments based on the salt deposits of Northeast Thailand and the offshore oil of South Vietnam. Agriculture, nevertheless, is likely to remain the dominant sector, continuing to provide most of the employment and the export earnings. The new technology is now available to assist agricultural development, but its full effects will not be gained until the traditional dependence on the unreliable rainfall regime of the region can be reduced. This calls for the construction of water control facilities on a much wider scale than previously attempted, controlling the flows of the wet season and making water available for the extension of cropping into other parts of the year. Using the experience already obtained, the needs of the growing population of the region and their increasing aspirations may better be satisfied.

It should be added, however, that the political conditions of the area must be improved if anything is to be achieved. Already warfare and continued political instability have ruined some parts, if not all of the economic structure of Laos, the Khmer Republic and the Republic of Viet-Nam and valuable resources are being taken up in countering insurgency in Northeast Thailand.

All the former countries have severe balance of payments deficits; indeed their economies have become almost completely dependent on massive supplies of foreign aid, mainly from the United States. Given peaceful conditions, mere rehabilitation of the economic and social structure will take up the major part of what national funds are available. There will be little to spare for major schemes like the Mekong mainstream projects. If these are to be constructed in the foreseeable future, much will depend upon international support. Fortunately the Mekong is an international river and in the Mekong Committee there has been founded an institution designed to enlist and co-ordinate such support. Already the work of the Mekong Committee has laid down the guidelines for the possible future development of the region and there appears to be renewed willingness on the part of some developed countries to assist the project. The experience gained so far in the international development of this major river basin may yet allow the successful implementation of the mainstream programme and so help transform the traditional agricultural economy of the region.

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